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Vol. 4 No. 12
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NUCLEAR SCIENCE ABSTRACTS

Vol. 4, No. 12

Table of Contents for June 30, 1950

Category	Abstract	Page
DOCUMENTS REFERENCE LIST		iii
BIOLOGY AND MEDICINE		547
Radiation Effects	3579	
Radiation Hazards and Protection	3603	
Radiotherapy	3609	
Toxicology Studies	3626	
Tracer Applications	3634	
CHEMISTRY		567
Analytical Procedures	3680	
Atomic Weights and Periodic Systems	3690	
Crystallography and Crystal Structures	3691	
Deuterium and Deuterium Compounds	3695	
Fluorine and Fluorocarbons	3697	
Laboratories and Equipment	3702	
Radiation Effects	3705	
Rare Earths and Rare Earth Compounds	3708	
Separation Procedures	3709	
Syntheses	3715	
Tracer Applications	3716	
Uranium and Uranium Compounds	3723	
ENGINEERING		574
Radiography	3729	
Tracer Applications	3730	
Vacuum Systems	3735	
MINERALOGY, METALLURGY, AND CERAMICS		575
Metals and Metallurgy	3736	
Minerals and Mineralogy	3740	
PHYSICS		576
Cosmic Radiation and Mesons	3751	
Instruments	3755	
Mass Spectrography	3757	
Measuring Instruments and Techniques	3759	
Meterology	3783	
Microwaves	3785	
Neutrons	3788	
Nuclear Properties	3796	
Nuclear Reactors	3802	
Nuclear Transformation	3804	
Particle Accelerators	3813	
Radiation Absorption and Scattering	3817	
Radioactivity	3824	
Theoretical Physics	3832	

TABLE OF CONTENTS FOR JUNE 30, 1950

Category	Abstract	Page
AUTHOR INDEX		A
SUBJECT INDEX		D
NUCLIDE INDEX		N
FOREIGN GEOGRAPHIC INDEX		O
PUBLISHED DOCUMENTS INDEX		P
NNES ANNOUNCEMENT		Q

DOCUMENTS REFERENCE LIST

Vol. 4, No. 12

U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED DOCUMENTS

Document	Title, Author	Abstract
AECD-2832	Validity and Usefulness of Currently Accepted "Tolerance Dose" for X- and γ-Radiation. Industrial Tolerance Conference.	3579
AECD-2833	Aplastic Anemia. William Valentine.	3567
AECD-2834	The Spectrographic Determination of Uranium in Ores and Ore Products. D. Kaufman and C. W. Perkins, Jr.	3723
AECD-2835	Neutron Diffusion Theory. Integral Theory Methods and Formulae. B. Carlson.	3788
AECD-2836	An Automatic Potentiometric Titrimeter. R. A. Widing and J. Farquharson.	3702
AECD-2837	Relative High Energy Neutron Yields from Targets Bombarded with Protons and Deuterons. W. J. Knox.	3789
AECD-2838	A Proposed Routine Method for Determining Uranium in Leach Liquors Containing Vanadium. J. F. Shea, F. Stephens, and A. C. Richardson.	3724
AECD-2839	Polonium Extraction Using a Platinum Electrode and Hydrogen. R. J. Prestwood.	3709
AECD-2840	100-Ton Test; Ground Vibrations. L. D. Leet.	3744
AECD-2841	100-Ton Test at Trinity. Report on Earth Velocity Measurements. J. H. Coon and H. M. Houghton.	3745
AECD-2842	100-Ton Test; Permanent Earth Movements, Earth and Air Shocks. W. G. Penney and F. Reines.	3746
AECD-2843	100-Ton Test; Mechanical Impulse Meter. T. Jorgenson, Jr.	3747
AECD-2844	Ground Vibrations from Trinity Tests. L. D. Leet.	3748
AECD-2845	Electroplating of Beryllium. M. Kolodney.	3736
AECD-2846	Studies of Recovery Processes for Western Uranium Bearing Ores: Part V. Tests of Specific Leaching of Carnotite Ores. C. F. Coleman.	3740
AECD-2847	An Indirect Method of Process Control. R. G. Durnal.	3726
AECD-2848	Total Cross Sections for 280-Mev Neutrons. I. R. Fox, C. Leith, L. Wouters, and K. R. MacKenzie.	3790
AECD-2849	Studies of Recovery Processes for Western Uranium Bearing Ores: Part VII. Wet Concentration. D. J. Crouse and K. B. Brown.	3741
AECD-2850	Separation of Phosphorus^{32} from Sulfur^{32}. J. N. Butler.	3710

DOCUMENTS REFERENCE LIST

Document	Title, Author	Abstract
AECU-742	Schistosoma Mansoni Miracidium under Phase Difference Microscopy. N. P. Watts, and G. A. Boyd.	3568
AECU-743	A Recommended Method for the Measurement of the Acute Toxicity of a Substance Administered by Intraperitoneal Injection. E. A. Maynard.	3626
AECU-744	Bone and Tooth Lesions in the Rat Resulting from Ingestion and Intraperitoneal Administration of Beryllium Compounds. E. A. Maynard, W. L. Downs, and J. K. Scott.	3627
AECU-745	The Minor Role of the Non-Hepatic Tissues in Plasma Protein Synthesis as Observed with the Aid of Lysine-ϵ-C^{14}. C. G. Bly, L. L. Miller, and W. F. Bale.	3634
AECU-746	Plasma Protein Synthesis as Observed in a Direct Study of the Liver with the Aid of Lysine-ϵ-C^{14}. L. L. Miller, C. G. Bly, M. L. Watson, and W. F. Bale.	3635
AECU-747	Selective Testicular Damage in Rats Due to X-rays. S. L. Shaver and K. E. Mason.	3580
AECU-748	The Effect of Aureomycin and Antibodies on Whole Body Irradiation. J. W. Howland, F. Furth, and M. Coulter.	3581
AECU-749	Character of Blood Changes in Acute Experimental Beryllium Poisoning. H. E. Stokinger, F. A. Smith, C. J. Spiegl, J. K. Scott, and C. A. Stroud.	3628
AECU-750	The Effect of Thiouracil on the Uptake of Radioactive Iodine by the Thyroid Gland of Summer Frogs (Rana pipiens). S. A. Matthews.	3636
AECU-751	Condensations Effected by Boron Fluoride Complexes. III. The Acylation of Certain Substituted Thiophenes and Furans. M. N. Farrar, and R. Levine.	3697
AECU-752	Radio Frequency Problems Associated with Particle Accelerators. J. P. Blewett.	3813
AECU-753	The Relative Rates of the Reactions of Hydrogen Iodide and Deuterium Iodide with Methyl Iodide. J. Bigeleisen.	3695
AECU-755	The Cross Section of (n,2n) Reactions near the Threshold. G. Snow.	3804
AECU-756	Isomerism in Pb^{204} and Radiations of Bi^{204} and Bi^{206}. A. W. Sunyar, D. E. Alburger, M. Friedlander, M. Goldhaber, and G. Scharff-Goldhaber.	3824
AECU-757	Photo-Neutrons Production. E. der Mateosian and M. Goldhaber.	3791
AECU-759	The β Spectrum of Be^{10}. D. E. Alburger, D. J. Hughes, and C. Eggler.	3825
AECU-760	A Radio-Frequency Spectrograph and Simple Magnetic-Field Meter. R. V. Pound and W. D. Knight.	3759
AECU-761	A Rapid Method for the Determination of Mutation Rate of E. coli. to Streptomycin Resistance. B. A. Rubin.	3569
AECU-762	The Effect of Growth in a Radioactive Culture Medium on the Mutation Rate of E. coli to Streptomycin Resistance. B. A. Rubin.	3582
AECU-763	Some Studies in Reaction Kinetics with Isotopic Tracers. R. W. Dodson.	3716
AECU-764	The Self Energies of Electrons and Photons. H. S. Snyder.	3832

DOCUMENTS REFERENCE LIST

Document	Title, Author	Abstract
AECU-765	The Genetics of Streptomycin Resistance Induced by Absorbed Radioactive Phosphorus (P^{32}). B. A. Rubin, and P. Steinglass.	3583
AECU-766	Oriented Overgrowth of Alkali Halides on Ag, Bi, Sb, and Fe. G. W. Johnson.	3691
AECU-767	Low Energy Photons from Radioactive Nuclei. G. Scharff-Goldhaber, E. der Mateosian, M. McKeown, and A. W. Sunyar.	3826
AECU-768	A Device for Making Point by Point Measurements of a Varying Frequency. R. L. Chase.	3755
AECU-769	A Proportional Counter X-ray Spectrometer. W. Bernstein, H. G. Brewer, Jr., and W. Rubinson.	3760
AECU-771	Interaction Between Paramagnetic Ions in Crystals. N. Elliott.	3692
AECU-772	Scattering of 4.5- and 5.5-Mev Neutrons by Deuterons. E. Wantuch.	3792
AECU-773	Magnetic Electron Multiplier for Detection of Positive Ions. L. G. Smith.	3761
AECU-774	Hyperfine Structure and Exchange Narrowing of Paramagnetic Resonance. C. H. Townes, and J. Turkevich.	3785
AECU-775	Blood Volume of the Rat Measured by the Tagged-Erythrocytes Dilution Method. L. M. Sharpe, G. G. Culbreth, and J. R. Klein.	3637
AECU-776	Phosphate Turnover in the Liver in Alloxan Diabetes. J. Sacks and B. Damast.	3638
AECU-777	The Adrenal Cortex and Survival of Rats after Irradiation. A. Edelmann.	3584
AECU-778	Determination of Circulating Red Cell Volume by Radioactive Chromium. S. J. Gray and K. Sterling.	3639
AECU-779	The Colorimetric Determination of Trace Amounts of Chromium in Tissue. A. M. Mitchell and S. J. Gray.	3680
AECU-780	The Half-Life of Carbon 14 and a Comparison of Gas Phase Counter Methods. W. W. Miller, R. Ballentine, W. Bernstein, L. Friedman, A. O. Nier, and R. D. Evans.	3827
AECU-781	Distribution of Labeled Carbon in the Sugars and Alanine of Sunflower Leaves after Exposure to $C^{14}O_2$ in the Light and Dark. M. Gibbs.	3640
AECU-782	Determination of the Mechanism of γ-Lactone Hydrolysis by a Mass Spectrometric Method. F. A. Long, and L. Friedman.	3717
AECU-783	A Monitor for Low Intensity Gamma Rays. J. B. H. Kuper, and R. L. Chase.	3762
AECU-784	A 300 to 4000-Kc Electrically Tuned Oscillator. A. I. Pressman and J. P. Blewett.	3814
AECU-785	The Effect of Electronic Paramagnetism on Nuclear Magnetic Resonance Frequencies in Metals. C. H. Townes, C. Herring, and W. D. Knight.	3796
AECU-786	Simultaneous Blood Volume Determinations in Dogs with Dye (T-1824) Carbon Monoxide and Radioactive Iron Fe^{55}. J. L. Nickerson, L. M. Sharpe, W. S. Root, T. C. Fleming, and M. I. Gregersen.	3641

DOCUMENTS REFERENCE LIST

Document	Title, Author	Abstract
AECU-787	Chemical Reactions of Energetic Chlorine Atoms Produced by Neutron Capture in Liquid Systems. J. M. Miller and R. W. Dodson.	3705
AECU-788	Modification to Weston 877 Densitometer. E. F. Hassell, R. C. Roth, and C. F. Stearns.	3756
AECU-789	Quantum Field Theory. H. S. Snyder.	3833
AECU-790	Sensitivity of Chromosomes to Breakage by X-rays and Its Relationship to the Nucleic Acid Cycle in Dividing Cells. A. H. Sparrow, M. J. Moses, and R. Steele.	3585
AECU-791	Kinetics of Some Electron Transfer Exchange Reactions Involving Thallium and Cerium. R. W. Dodson, L. Eimer, J. Gryder, and G. Harbottle.	3708
AECU-792	On the Mechanism of Bacterial Fermentation of Glucose to Lactic Acid Studied with C^{14}-Glucose. M. Gibbs, R. Dumrose, F. A. Bennett, and M. R. Bubeck.	3642
AECU-793	On Scattering Induced Curvatures for Fast-Charged Particles. W. T. Scott and H. S. Snyder.	3817
AECU-794	Quantum Electrodynamics: The Self Energy Problem. H. S. Snyder.	3834
AECU-795	Radioactive Crystalline Ribonuclease. C. B. Anfinsen.	3643
AECU-796	Oriented Overgrowth of Alkali Halides in Metals. G. W. Johnson.	3693
AECU-797	The Interaction of Pi-Mesons. O. Piccioni.	3651
AECU-798	Stars and Showers at Balloon Altitudes. A. M. Thorndike and A. M. Wotring.	3752
AECU-799	The Non-Utilization of Streptomycin by Resistant E. coli Mutants. B. A. Rubin and P. Steinglass.	3570
AECU-800	Monitor for Airborne Radioactive Dust. J. B. H. Kuper, E. H. Foster and W. Bernstein.	3763
AECU-801	The Relation of Growth Patterns in Radioactive Media to the Mechanism of Genetic Change in Escherichia coli. B. A. Rubin and P. Steinglass.	3586
AECU-803	Photoperiodic Effect on Corn Grass (CG/+). W. R. Singleton.	3571
AECU-804	No Stimulation from X-rays or Gamma Rays. W. R. Singleton.	3587
AECU-805	Segregation for Sucrose Storage in Corn Stalks. W. R. Singleton and R. Van Reen.	3572
AECU-806	Sucrose Storage in Corn Stalks. R. Van Reen.	3573
AECU-807	Quantitative Determination of Nucleic Acids During Meiosis in Trillium. M. J. Moses, R. Steele, and A. H. Sparrow.	3574
AECU-808	Metabolism of Soy Bean Leaves. I. On the Sequence of Formation of the Soluble Carbohydrates During Photosynthesis. S. Aronoff and L. Vernon.	3644
AECU-809	The Exchange Reaction Between Aluminum Chloride and Carbon Tetrachloride. C. H. Wallace and J. E. Willard.	3718
AECU-810	Velocity Dependent Nuclear Interactions. C. H. Blanchard, R. Avery and R. G. Sachs.	3797

DOCUMENTS REFERENCE LIST

Document	Title, Author	Abstract
AECU-811	A Metallurgical Investigation of Silver Chloride. R. D. Moeller, F. W. Schonfeld, C. R. Tipton, Jr., and J. T. Waber.	3737
AECU-813	Basic Techniques in the Use of C^{14} as a Tracer. I. Apparatus and Techniques for the Wet Combustion of Non-Volatile Samples. C. K. Claycomb, T. T. Hutchens, and J. T. Van Bruggen.	3703
AECU-814	Basic Techniques in the Use of C^{14} as a Tracer. II. Preparation of $BaCO_3$ Plates by Centrifugation. T. T. Hutchens, C. K. Claycomb, W. J. Cathey, and J. T. Van Bruggen.	3719
AECU-815	Basic Techniques in the Use of C^{14} as a Tracer. III. A Semi-Micro Synthesis of C^{14}-Carboxyl Labeled Acetic Acid. J. T. Van Bruggen, C. K. Claycomb, and T. T. Hutchens.	3720
AECU-816	Scattering and Capture of Protons by Aluminum. F. C. Shoemaker, J. E. Faulkner, S. G. Kaufman, and G. M. B. Bouricus.	3818
AECU-818	$C^{14}O_2$ Assimilation by Soy Bean Leaves. S. Aronoff and L. Vernon.	3645
AECU-819	A Correction to be Applied to the Activity of Neutron Activated Cadmium Covered Indium Foils. J. W. Kunstadter.	3805
AECU-820	The Synthesis of L-Ascorbic Acid Uniformly Labeled with C^{14}. A. A. Bothner-By, M. Gibbs, and R. C. Anderson.	3721
AECU-821	A Cytological and Cytochemical Approach to an Understanding of Radiation Damage in Dividing Cells. A. H. Sparrow.	3588
AECU-822	Consideration of the Relationship between Chromosome Breakage and Mitotic Inhibition Induced by Ionizing Radiation. A. H. Sparrow.	3589
AECU-823	Altitude and Latitude Dependence of Bursts in a Lead Shielded Ion Chamber. A. J. McMahon and B. Rossi.	3753
AECU-825	Manganese Metabolism of Social Vespidae. V. T. Bowen.	3646
AECU-826	Ground Level Measurements of Oil-Fog Emitted from a Hundred Meter Chimney. Meteorology Group, BNL.	3783
AECU-827	A High Speed Expansion Valve for Cloud Chamber Control. R. P. Shutt and W. L. Whittemore.	3764
AECU-828	Isotope Effect on Bond Rupture by Electron Impact on Hydrogen, Deuterium, and Tritium. O. A. Schaeffer and J. M. Hastings.	3706
AECU-829	Radioautography of Cerebral Tumors Employing P^{32}. D. Steinberg and B. Selverstone.	3647
AECU-830	Difference in the Effects of X-irradiation in Rat Embryos of Different Ages. J. G. Wilson, and J. W. Karr.	3590
AECU-831	Studies on Ferritin. B. W. Gabric.	3575
ANL-4360	Quarterly Report August, September, October, 1949. Biology and Medicine Div. A. M. Brues, and H. Lisco.	3591
ARSC-31	The Development of a Destructor for Processing Solid Combustible Radioactively Contaminated Waste. F. T. Crego, W. B. Moen, C. J. Sullivan, and A. Muller.	3603

DOCUMENTS REFERENCE LIST

Document	Title, Author	Abstract
ISC-78	Progress Report in Radiochemistry. May 1, 1949, to October 31, 1949. A. F. Voigt.	3711
K-591	A System for the Collection and Purification of Radon by Remote Control. C. H. Shiflett, M. E. Steidlitz, and W. Davis.	3727
LA-1075	The Effect of Acute Doses of X-irradiation on the Splenic and Thymic Weight of CF-1 Female Mice. R. E. Carter, P. S. Harris, and J. T. Bennan.	3592
MITG-224	The Beryl Picker. J. H. Pannell and W. L. Freyberger.	3742
NYO-542	Progress Report for September 1949. C. G. Moore, D. S. McKinney, and J. C. Warner.	3749
NYO-607	Solvent Extraction of Inorganic Ions. Fourth Quarterly Progress Report. L. G. Bassett, S. E. Wiberley, J. Savolainen, and H. M. Clark.	3712
ORNL-464	Changes in the Composition of the Blood Plasma of the Guinea Pig During the Acute Radiation Syndrome. H. I. Kohn.	3593
ORNL-639	Neutron Detection by Means of Film Blackening and Related Shielding Phenomenons. T. E. Shea, Jr.	3793
ORNL-659	An Automatic Control Valve for Fluorine Storage Tanks. T. W. Hungerford and D. C. Gary.	3728
ORNL-662	Anion Exchange Studies. II. Tantalum in Some HF-HCl Mixtures. K. A. Kraus and G. E. Moore.	3713
UCRL-652	Carrier-Free Radioisotopes from Cyclotron Targets. IX. Preparation and Isolation of $Re^{183,184}$ from Tantalum. J. D. Gile, W. M. Garrison, and J. G. Hamilton.	3714

3567 Aplastic Anemia. William Valentine. AECD-2833, Jan. 22, 1945, Decl. Apr. 28, 1950. 12p.

The purpose of this report is to obtain in so far as possible from the literature the following facts: (1) the incidence of aplastic anemia, particularly the secondary type, in individuals exposed to noxious agents; and (2) the blood picture in aplastic anemia with particular reference to the early hematological changes which might serve as warning signs and permit corrective measures to be instituted before the condition becomes serious; here again this is largely concerned with individuals working in occupations in which there is danger of blood dyscrasias of this type developing. 17 references.

3568 Schistosoma Mansoni Miracidium under Phase Difference Microscopy. N. P. Watts and George A. Boyd. AECU-742, nd. 6p.

The development of the phase-contrast microscope provides means of observing structural details in many organisms. Substances of greater dielectric constants (and hence greater indices of refraction) have a longer light path, and this difference becomes visible in varying shades from light to dark, giving a type of optical staining in living and fixed tissues. Photographs illustrating the use of the instrument are presented and discussed. The living form of the miracidium of Schistosoma mansoni, immobilized by chlorobutanol, was used.

3569 A Rapid Method for the Determination of Mutation Rate of E. coli to Streptomycin Resistance. B. A. Rubin. AECU-761, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

In a study of the background mutation rate to streptomycin, a method has been devised here which is analogous to that used in phage mutation-rate studies. The validity of this method has been carefully checked.

Approximately 100 tubes containing approximately 1 ml of a complete culture medium were uniformly inoculated with ~ 100 organisms. After 24 hr, when growth was complete, 9 ml of the same media containing 2000 units of streptomycin was added to each tube. In the following days a number of tubes showing additional growth were noted, the remaining tubes were tested and found to be sterile. In these latter tubes the dead bacteria were completely sedimented, leaving a clear supernate, but where a mutant had appeared, the supernate was turbid enough to permit rapid identification. When the proportion of tubes showing additional growth was small, it was possible to demonstrate the presence of viable bacteria which in any one tube were derived from a single mutant by an analysis of the level of streptomycin requirement.

The validity of the method was demonstrated in two ways: first, by comparison of the mutation rate in different complete media in which there were widely different levels of final growth; and by comparison with a plating method using exactly the same arrangement, but actually counting the numbers of mutant colonies. Both of these comparisons gave equivalent results, probably indicating that there was no further growth in the medium when streptomycin was added and that statistically a good estimation of the mutation rate could be made by counting the number of tubes

showing mutant growth. If the proportion of tubes containing mutants is kept small, the calculations are simpler, and it is also possible to accurately identify the sequence of mutant types. It was noted that the mutants in the tubes did not all appear on the same day. The mutants which appeared earlier tended to be mostly nonrequiring resistants, while the reverse was true in those appearing later. This method has also been tested recently by Dr. H. P. Treffers at Yale and has been found to provide results similar to those described here. (auth)

3570 The Non-Utilization of Streptomycin by Resistant E. coli Mutants. B. A. Rubin and P. Steinglass. AECU-799, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Studies of interrelationships among streptomycin-resistant mutants of E. coli B/r have suggested that the utilization of streptomycin by some mutant strains may prevent the growth of other strains (which require the drug) or reduce the antibiotic level to a point where sensitive organisms may survive. In testing this possibility, four mutants were grown in a complete media containing various levels of streptomycin from which aliquots were periodically Chamberlain filtered and assayed for the drug residual. Although testing continued for several days after complete growth, there was no evidence of any loss of streptomycin.

The mutants tested were random samples of different types. (1) SR—resistant, nonrequired. (2) SDL—resistant, requiring 10 to 25 units/cc. (3) SDH—resistant, requiring at least 100 units/cc. (4) SD-500—requiring at least 500 units/cc, but growing best in about 20,000 units/cc. Even when the streptomycin content was reduced to a minimum on which the organism could manage, there was still no detectable utilization. The assay was done by the standard inhibition zone technique, using Staphylococcus aureus 9996, and also by a modified turbidimetric method, using the parent sensitive strain of E. coli B/r. Sterile controls receiving identical treatment, including Chamberlain filtration, were always run. No difference from controls was ever found in the case of the Staphylococcus assay. Using E. coli, some anamolous dose response curves were occasionally seen; these indicated the production of some toxic material by the mutant strains, but no utilization of streptomycin. It may be possible that it is an impurity in the streptomycin which is being utilized.

3571 Photoperiodic Effect on Corn Grass (CG/+). W. Ralph Singleton. AECU-803, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

In last year's News Letter, it was reported that Corn Grass plants show a remarkable response to length of day. These results were repeated in 1949. Plants grown from the October 1 planting produced few tillers, were upright in growth, and produced tassels that shed good pollen, whereas the September 15 sowing produced typical Corn Grass plants with many tillers and no tassels. All plants were grown with no supplemental light. The change in type of growth took place earlier in 1949 (October 1) than in 1948 (November 1), although in the October 15, 1948, planting there was a more or less intermediate type. In 1949 plants were all crosses

of Mangelsdorfs multiple tester and Corn Grass, while those in 1948 were from open-pollinated Corn Grass pollinated by normal corn.

In the 1948 fall crop, the tall type of plant persisted for only two sowings. November 1 and 15 and plants from the two December sowings produced almost normal Corn Grass, with the exception that a few tassels were produced. The January 1 sowings resulted in completed normal Corn Grass plants with no tassels.

Perhaps modifying genes have been introduced into the Corn Grass plants, causing some tassel formation in the field in the summer of 1949. Thus it was possible to make a considerable number of controlled crosses more easily with different leakage testers, and it should be possible to establish linkage with this gene fairly soon. Pollen of Corn Grass was put on Teopod ears to determine if these two dominant genes are allelic. Corn Grass has some of the characteristics of Teopod, but is much more striking and shows a greater difference from normal corn than Teopod.

3572 Segregation for Sucrose Storage in Corn Stalks. W. Ralph Singleton and Robert Van Reen. AECU-805, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

In last year's News Letter (No. 23) we reported refractometer readings for segregating for progenies between C103 and T1. In 1949, readings were made on segregating progenies of crosses of C103 with the following inbreds: C22(su), C102, R 4, Hy, 38-11, Os420, I 159, Oh 40B, CI 7, DT 21, I 205, Wf9, and 1188, a rd field corn line. The C102.103 F_2 progeny showed the narrowest range of refractometer readings, from 10.75 to 16.75 in one progeny, while in a second progeny the range was from 6.25 to 16.75 with an indication of a bimodal curve for this progeny. At least three of the progenies C103.38-11, C103.Wf, and C103.Hy gave distinctly bimodal curves, with approximately 25% of the readings centered around a low mode 3.25 for 38-11, 6.25 for Wf, and 6.25 for Hy, with the respective high modes of 11.5 for 38-11, 10.75 for Wf and Hy. These data indicate that true low sucrose behaves as a recessive. Readings will be made on the F_3 generation this summer.

Inbreds show marked differences in the way they maintain total solids in the stalks as the grain is filling. Two weeks after pollination Wf has almost as high a refractometer reading as C103 (more than 12%) but 50 days later the percentage for Wf9 has dropped to about 4%, while 103 has gone up to 15% and then back to 12%. Inbred 38-11 shows a similar pattern to C103, but in a lower range, going from 6.5 to 8.5%, and then falling to 5% as the grain matured. C102 showed considerable variation from plant to plant, but in a lower range than C103. C102 is a Lancaster Sure Crop line as is C103.

The genetic picture for sucrose storage is still obscured by other factors that affect amount of sucrose present in the stalk when the grain is mature. One of these factors is the size of ear produced. An incompletely filled ear will have a higher reading than one completely filled, although high readings have been obtained on some plants having well-filled ears.

Time of sampling is another factor influencing solids present in stalk juice, since some lines lose solids very

fast as they mature, while for others such as C103 the solids present remain fairly constant.

The possible amount of sunlight a plant receives affects total solids stored. In 1948 at Mt. Carmel, Connecticut, there was a tendency for end plants on the south end of the row to have a higher reading than plants in the row. It is also probable that soil fertility will have some influence.

All these variable factors must be controlled as well as possible before accurate genetic analysis can be made.

3573 Sucrose Storage in Corn Stalks. Robert Van Reen. AECU-806, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Several lines of corn have been investigated during the past year to determine the extent of sucrose storage in the stalk after maturation of the ear. Single-ear progenies of C103, Ind. 38-11-2A, Ind. 38-11-CtS1CtS3, and T1 inbreds were grown, and the stalk press-juice was analyzed for reducing sugars and sucrose by the method of Shaffer-Somogyi. Along with the chemical analyses, the percentage of total solids in the press-juice was obtained, using a Bausch and Lomb hand refractometer. The refractometer readings were compared with the sucrose content, and a correlation coefficient of 0.79 was calculated. Since there is such a high correlation, it is possible to obtain a fairly accurate estimate of sucrose production and storage by using the hand refractometer. By so doing it is possible to analyze many more plants than would be feasible chemically.

The mean refractometer readings found for the lines investigated are given in Table 1.

Table 1 — Mean Refractometer Readings of Mature Field Corn (Su Su) Inbreds

Row	Pedigree	No. of plants	Mean refractometer reading % total solids	
609	C103	25	8.3	0.50
610	C103	25	12.2	0.44
640	C103 (progeny of 610)	20	11.3	0.84
641	C103	20	12.0	1.00
658	C103	23	10.7	0.50
692	C103	22	14.0	0.58
693	C103	22	15.5	1.10
638	Ind. 38-11-2A	21	4.9	0.59
639	Ind. 38-11CtS1CtS3	20	4.8	0.47
659	T1HP	20	6.9	0.51

The results for the C103 plants are not markedly different from the plants analyzed at New Haven (10.8 to 15.3 for 32 plants) and at Yaphank (10.0 ± 0.67 to 15.1 ± 0.29) reported by Singleton in last year's News Letter. Row 640 which was a greenhouse progeny of 610 gave refractometer readings comparable to those of 610.

The chemical analysis of the stalk press-juice of the T1 line substantiated earlier findings that the sugars present in this line are mainly reducing sugars and not sucrose. An analysis of 20 samples of T1 showed reducing sugars and sucrose contents of 3.5 and 1.4%, respectively. This gives

a value of 2.5 for the ratio of reducing sugars to sucrose. The chemical analysis of 22 samples of C103 (Row 610) showed reducing sugars and sucrose contents of 1.3 and 6.8%, respectively, or a ratio value of 0.2. Further studies will be conducted to determine the cause of this pronounced difference.

Other studies concerning sucrose formation and translocation are being planned, utilizing C^{14} as a tracer. One problem of interest concerns the ability of the plant to translocate sucrose from the leaf to the stalk against an apparent concentration gradient.

3574 Quantitative Determination of Nucleic Acids During Meiosis in Trillium. M. J. Moses, R. Steele, and A. H. Sparrow. AECU-807, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Quantitative determinations of pentose and desoxypentose nucleic acids (PNA and DNA) have been made on the anther contents (pollen mother cells) of Trillium erectum at various stages of miosis. Methods of quantitative microchemical and cytochemical analysis were employed and will be discussed. The data (amounts of DNA per cell) as obtained by both methods will be presented and compared. Similarities and differences between them will be discussed with respect to nuclear changes during division. (auth)

3575 Studies on Ferritin. Beverly Wescott Gabric. University of Rochester. AECU-831, 1950. 157p.

The work reported in this dissertation is concerned primarily with the development of a quantitative assay method for ferritin, an investigation of some chemical properties of the ferritin molecule, and a study of certain phases of its function in the body. The several sections of the dissertation include: historical background, experimental plans and procedures, results and discussion (chemical properties, paper chromatography, quantitative assay), and some aspects of ferritin distribution and metabolism). 11 references.

3576 Abnormal Bleeding. II. Further Clinical Experience with Toluidine Blue and Protamine Sulfate. J. Garrott Allen, Burton J. Grossman, Richard M. Elghammer, Peter V. Moulder, Charles L. McKeen, Margaret Sanderson, Willadene Egner, and James M. Crosbie. Surg. Gynecol. Obstet. 89, 692-703 (1949) Dec. (See also NSA 4-2541.)

Coagulation studies including protamine titration, clotting time, prothrombin activity, clot retraction, and clot lysis and general hemocytological studies including erythrocyte, leucocyte, thrombocyte, and leukocyte differential counts were done on a total of 56 patients with and without evident hemocytological disorders. Eight cases are presented in detail; the others are tabulated in terms of: before and after therapy studies, age, symptoms, diagnoses, and results of therapy, for cases of acute and chronic leukemia, radiation sickness following P^{32} and I^{131} administration, and x-ray therapy (150 r spray), Hodgkin's disease, and thrombocytopenia. The methods of therapy and studies are completely described; toluidine blue administration ranged from 2.0 to 8.0 mg/kg at various intervals (usually daily for 1 to 6 days), and protamine administration ranged from 2 to 4.5 mg/kg in conjunction with the toluidine blue administration (more frequently toluidine blue was given alone than the protamine, although in most cases they were used conjointly). A clotting defect is described as a result of these studies which may be found in association with various vascular disorders, especially those involving the hematopoietic system; it is characterized by increased protamine titration and usually responds to toluidine blue and protamine sulfate administration.

BIOLOGY AND MEDICINE

3577 Neutralization of the Anticoagulant Effects of Heparin with Protamine (Salmine). Thomas W. Parkin and Walter F. Kvale. Am. Heart J. 37, 333-42(1949) Mar.

After a brief discussion of the literature and previous experiments on protamine sulfate toxicity, experiments are described, testing the neutralization of heparin in vivo in dogs and humans. Normal and heparin coagulation times were found on three dogs; four others received intravenous heparin injections of 1.0 mg/kg, and after 15 min 1.5 mg/kg of salmine sulfate was injected; clotting times were determined at 0, 30, 45, and 60 min after salmine injections. Another series was done, involving the intramuscular injection of 12 mg/kg of heparin followed by 1 mg/kg doses of salmine at 60 and 75 min, after which the coagulation times were determined at various intervals for 24 hr. Further experiments were performed on 10 humans, who received 50 mg of heparin intravenously, followed after 15 min by 15 to 50 mg of salmine sulfate; coagulation times, blood pressure, and pulse rate were determined for 3 hr. The authors conclude that salmine neutralized the anticoagulant effect of intravenous injections of heparin in dogs and temporarily decreased the elevated coagulation time after intramuscular heparin injections; they also concluded that in humans 40 to 50 mg of salmine sulfate neutralized the anticoagulant effect of 50 mg of heparin and did not produce any reactions. 25 references.

3578 Observations on the Clotting Mechanism in Menstruation and Menorrhagia. Richard M. Elghammer, Burton J. Grossman, Arthur K. Koff, Peter V. Moulder, and J. Garrott Allen. Surg. Gynecol. Obstet. 89, 764-6(1949) Dec.

This is a report of coagulation data on 43 patients with menorrhagia, 24 normal female, and 56 normal male volunteers, including protamine titration, clotting time, prothrombin time, clot lysis and retraction, and platelet count. The response to protamine sulfate and toluidine blue administration is discussed and tabulated. The authors found abnormalities of protamine titrations more frequently in menorrhagic patients than normals which were more observable at menstruation than during the intermenstrual periods; concurrent prolonged clotting time and slight thrombocytopenia were found with other abnormalities; gross evidence of fibrinolysin was found in only one case.

3579 Validity and Usefulness of Currently Accepted "Tolerance Dose" for X- and γ-Radiation. Industrial Tolerance Conference. AECD-2832, 1945. 98p.

The main purpose of this conference was to consider the validity and usefulness of the currently accepted human

tolerance dosages for x- and γ-radiation, namely, 0.1 r/day for an unlimited length of exposure. Papers were presented on the following subjects: chronic experiments correlating near-tolerance dosages with survival, blood changes, aging, genetic mutations, and skin changes; the mechanism of radiation effects; and the human tolerance dose.

3580 Selective Testicular Damage in Rats Due to X-rays. Samuel L. Shaver and Karl E. Mason. AECU-747, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

A dosage of 500 r total-body x-irradiation, administered in approximately 8 min, has proved most suitable for producing minimal but selective effects upon the testis of the rat.

In 52 rats given this dose there was negligible cell damage in the germinal epithelium when testis smears were studied supravitally and by fixation and application of histochemical methods for glycogen, lipids, and mitochondria. However, in histological sections of testes taken at frequent intervals during the first 2 weeks after irradiation, there occurs a progressive diminution in, and ultimately almost a complete loss of, spermatogonia; yet spermatogenesis continues normally. During the following 2 weeks, primary spermatocytes gradually diminish, and cells in advanced phases of spermatogenesis predominate. Approximately 10 days later there is evidence of early regeneration in the basal layers.

The infrequent occurrence of necrosis or pycnosis in spermatogonia and other germ cells, the abundance of mature sperm usually uncontaminated with sloughed germ cells in the epididymis, and the fact that the time required for these phenomena approximates the duration of the spermatogenic cycle (about 26 days) suggest a specific but temporary inhibition of the somatic mitotic divisions in the spermatogonia. This is further supported by observations on prepubertal rats given the same dosage and on adult rats showing a similar degree of testis injury after 1,005 r irradiation applied locally to the testis.

3581 The Effect of Aureomycin and Antibiotics on Whole Body Irradiation. Joe W. Howland, Frank Furth, and M. Coulter. AECU-748, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Results are presented on the exposure of more than 1,200 rats and 18 dogs to lethal doses of filtered 250 kvp x-radiation. Clinical doses of aureomycin or other combined antibiotics given to rats after lethal x-radiation results in almost complete alleviation of the diarrheal state. Survival of life is prolonged an additional 5 to 7 days. Animals die of a sudden hemorrhagic death. Preradiation weight may be regained as early as 4 days after exposure. Bacteriological studies show suppression of normally occurring gram-negative organisms in the intestinal tract.

Dogs treated with only clinical doses of aureomycin (equivalent to 50 to 100 mg/kg) or combined aureomycin-streptomycin have shown no evidence of radiation sickness. Occasional bleeding tendencies are associated only with local trauma. Survival of life is prolonged from 10 to 14 days. Deaths in control animals occur between the 10th to 14th day; in treated animals, after the 22nd day. Mortality in the dog is considerably improved. To date all dying treated animals have shown sepsis with aureomycin- or streptomycin-resistant organisms 48 hr before death, with the same organism being cultured post-mortem from all tissues examined. Pathological findings in the treated animals have not been, in general, typical of radiation disease. Lesions of the gastrointestinal canal have not been observed in the treated animals. Bacteriological observations indicate a general alteration in the bacterial flora of the intestinal canal with a suppression of gram-negative organisms.

BIOLOGY AND MEDICINE

3582 The Effect of Growth in a Radioactive Culture Medium on the Mutation Rate of E. coli to Streptomycin Resistance. B. A. Rubin. AECU-762, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

In the past most experiments dealing with the genetic effects of radiation have examined the survivors of a culture in which most of the individuals have been killed by the treatment. Lethal effects have been considered related to the increased mutation rate among the survivors. Indeed, it has recently been postulated by Kelner and by Szilard that the same mechanism is involved in both killing and mutation with ultraviolet irradiation.

A modification of the usual technique of irradiation gives a different sequence of events. When a small number of bacteria is inoculated into a complete medium containing sufficient P^{32} to produce up to about 100 r/min, there is almost normal growth rather than a decrease in bacterial count (after a suitable incubation period at 37°C). The integrated dose for the whole period may exceed 100,000 r.

Growth curves, plotted by an automatic recording turbidimeter, showed that under these conditions the effect of radiation on growth was to increase the lag period. The difference in response between B and B/r cultures is very marked, the former showing a much greater increase in lag than the latter. Aside from the effect of increasing the length of the lag period, P^{32} seemed to change the characteristic growth of the cultures very little. The final growth attained was about the same; the slope of the logarithmic phase was constant, and there was little change in morphology. After growth was complete, however, the continuing radioactivity of the medium initiated a decrease in viable count, which varied directly with the concentration of P^{32}.

Up to very high levels of P^{32}, the growth curves of the B/r cultures showed no difference whatever from the control cultures (containing no radiation), while at the same time there were striking increases in the mutation rate; and although there was a great difference in growth response between the B and B/r cultures, there was but little difference in their mutation rates at the comparable levels of P^{32}. If anything, the rates in the B/r culture ran slightly higher. In these experiments the effect of the β radiation from P^{32} on the growth of E. coli is evidently unrelated to its mutagenic activity.

The mutants seemed more susceptible than the nonresistant organisms to the killing effects of radiation, since their numbers declined relatively more rapidly with higher levels of P^{32}. The complex picture of delayed phenotypic expression of these mutations is described elsewhere.

It may be interesting to note that analogous results have been obtained in this laboratory by Dr. A. H. Sparrow, using higher plants — potatoes and Tradescantia. Continuous gamma radiation during the whole growing season permitted the attainment of a fairly normal yield of potatoes, while a similar dose of x-rays delivered rapidly to the tubers before planting caused a great decrease in yield. In Tradescantia the results are not yet clear, but there are similar indications of good growth, even with a significant amount of damage to the chromosomes. (auth)

3583 The Genetics of Streptomycin Resistance Induced by Absorbed Radioactive Phosphorus (P^{32}). B. A. Rubin and P. Steinglass. AECU-765, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

In the study of the mechanism of genetic effect induced by P^{32} in E. coli B/r, the use of the phenomenon of streptomycin resistance has proved to be both a good quantitative tool and an interesting subject in itself.

As a genetic tool, it has been possible to develop techniques similar to those used in the phage studies. Rapid and accurate estimates of the background mutation rates are now possible, which also provide simple methods for the isolation of the various types of resistant mutants. In this manner it has been possible to readily demonstrate the additional biochemical dependence of the mutants, their streptomycin requirements, and relative growth rates. Many of the objections to similar phage studies are eliminated by the stability of the drug and its lack of response to mutagenic agents — in this case, specifically β radiation and the products thereof.

In the radiation experiments the variations in delay of phenotypic expression have necessitated kinetic studies which could interrelate the pattern of genetic events. The kinetics were useful in their ability to demonstrate qualitative as well as quantitative genetic changes, produced by variations in the porportion of mutant types.

In these experiments the mutants varied with regard to their acquired need for the drug, but all organisms selected in 200 units/ml were resistant to 100,000 units/ml. Such characteristics are of significance in understanding the problems of chemotherapy. The responses of bacterial populations to streptomycin have helped elucidate quantitative aspects of drug resistance. Good predictions can now be made of the likelihood of producing resistant organisms and of methods for preventing this difficulty under conditions of practical therapy. (auth)

3584 The Adrenal Cortex and Survival of Rats After X-irradiation. Abraham Edelmann. AECU-777, nd. 1p.

The document is in abstract form; it is reporduced below in its entirety.

Protecting the adrenals of male rats by means of lead shields placed about the glands significantly increased the survival incidence following 850 r of x-irradiation (160 kvp, 10 ma, 0.15 mm Cu). X-irradiation (650 r) shortens the lives of adrenalectomized rats from an average of 8 days to 4 days. Substitution therapy in the adrenalectomized rat is effective, inasmuch as 3 cc/day of a whole gland adrenal extract (Upjohn) or 5 mg/day of desoxycorticosterone acetate resulted in 20 and 40% mortalities, respectively, at 15 days after 600 r, whereas 90% of the adrenalectomized controls were dead at this time. It is thought that the adrenal cortical response to x-irradiation is similar to that following any other stress. (auth)

3585 Sensitivity of Chromosomes to Breakage by X-Rays and Its Relationship to the Nucleic Acid Cycle in Dividing Cells. Arnold H. Sparrow, Montrose J. Moses, and Robert Steele. AECU-790, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The number of chromosome breaks produced after irradiation by 50 r of 160 kv x-rays at various stages of the miotic nuclear cycles have been studied in Trillium erectum. Sensitivity, as determined by counting the number of chromosome fragments, shows at least a 50-fold change. It is highest at late prophase and first metaphase and lowest at early postmiotic interphase. Since production of acentric fragments leads to cellular dysfunction and death, it is reasonable to assume that our sensitivity curve is a measure of the ability of the cell to recover from radiation damage.

The experimental modification of the sensitivity of dividing cells (e.g., tumor cells) to x-ray damage would be facilitated by an understanding of the biochemical systems immediately involved. In hopes of delineating some of the factors which determine either high or low sensitivity of the chromosomes to breakage and since metabolism of the nucleic acids has been shown to be easily upset by x- and ultraviolet irradiation, an attempt was made to correlate changes in PNA and DNA during miosis with sensitivity of the chromosomes to breakage. Microchemical analyses of the DNA and PNA content of Trillium pollen mother cells (PMC) at different miotic stages show no significant change in amount of either DNA or PNA per PMC throughout divisions. The significance of these results in terms of changes in nucleic acid concentration, synthesis, "target" size, and physical effects will be briefly discussed.

3586 The Relation of Growth Patterns in Radioactive Media to the Media to the Mechanism of Genetic Change in Escherichia coli. B. A. Rubin and P. Steinglass. AECU-801, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Usually experiments dealing with genetic effects of radiation have been concerned with an examination of survivors in a culture in which most organisms were killed. This lethal effect has been considered a related and necessary aspect of the production of mutations. A modification of the usual technique of radiation has provided a method for distinguishing genetic death from physiological killing. When bacteria are inoculated into a medium containing a radioactive isotope (P^{32}) there may be apparently normal growth, while the mutation rate (streptomycin resistance) is greatly increased. Growth curves, plotted by an automatic recording turbidimeter, showed that when continuous radiation did produce an effect on growth it was usually to increase the lag period; logarithmic phase and total yield were indistinguishable from controls. In comparing the B and B/r strains of Escherichia coli, it was found that the effect of

the radiation on lag was much greater in the B strain than in B/r. Although the effect on growth was much more pronounced in the B strain, B/r showed a greater increase in mutation frequency. It was in experiments with the latter strain that even where the growth pattern was completely normal, striking genetic changes were observed. In no case, however, were there many detectable mutants until after a period of "phenotypic lag." When growth was complete, the continuing radioactivity of the medium initiated a decrease in viable count which varied directly with the P^{32} content, but seemed to affect mutant cells more rapidly than normals. (auth)

3587 No Stimulation from X-Rays or Gamma Rays. W. Ralph Singleton. AECU-804, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Various workers have reported at different times preliminary data showing stimulation of slight amounts of radiation. Most, if not all, of these reports are based on limited data and, so far as we are aware, no extensive experiments have corroborated these preliminary indications of stimulation.

Last summer an experiment was planned to determine any stimulating effects of x-rays and gamma rays. The x-ray used was set at 160 kv and 10 ma. Doses given were 250, 500, 1,000, and 2,000 r. Comparable doses of gamma rays were given by placing the seeds (in Petri dishes) at a distance of approximately ½ meter from a 16-curie source of Co^{60}. Four different 4 by 4 latin squares were planted with seed given the four different dosages of x-rays and gamma rays. In two latin squares standard early field corn was grown. In the other two, short hybrids with the reduced gene (rd) were grown. These were used because it was thought that small differences in height might be more readily detected. In all the latin squares, 4-row plots were planted, using a split-plot technique whereby two rows were checks with no treatment and for two rows the seed was radiated.

Height measurements were made at weekly intervals on one of the four replications of each latin square, and total height was obtained on the mature plants of all plots. There was no significant difference in height of any of the 4 x-ray treatments or the 4 gamma-ray treatments in comparison with the controls. Likewise, the yields showed no significant difference for any treatment. Experiments will be run in 1950, using doses of 2,000, 4,000, 8,000, and 16,000 r of both x- and gamma rays. On the basis of present information it seems unlikely that a stimulating effect will be found. Certainly none was found, using doses of 250, 500, 1,000, and 2,000 r of either x-rays or gamma rays. Neither was a depressing effect formed for any of the dosages used. (auth)

3588 A Cytological and Cytochemical Approach to an Understanding of Radiation Damage in Dividing Cells. Arnold H. Sparrow. AECU-821, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Analysis of induced chromosome fragmentation following irradiation at different stages in the nuclear cycle (miosis) of Trillium erectum indicates that major changes in the radiation sensitivity of the chromosomes occur. Two types

of fragments have been observed and scored: (a) those which become visible at the metaphase or anaphase immediately following prophase irradiation, and (b) those which are detectable only after the chromosomes have passed through an interphase and entered the succeeding metaphase. When both types are considered, it is found that irradiation at late prophase (diplotene-diakinesis) and metaphase stages yields a very large number of fragments, and irradiation at late telophase and early interphase produces relatively few fragments. Since loss of nuclear material is proportional to the induced fragmentation, it may be assumed that the amount of chromosome fragmentation is a fair index of eventual cell lethality (and probably also of mutation). It therefore becomes of considerable significance to try to determine the factors controlling the degree and manner in which the chromosomes react to ionizing radiation. Morphological changes and physical factors (stress, repulsion, etc.) are known to be important. Submicroscopic, cytochemical, and cytophysiological changes are also very important but, unfortunately, less well known.

Measurements of desoxypentose nucleic acid (DNA) at stages of high and low sensitivity indicate that total DNA is not related to radiation sensitivity; however, its rate of synthesis or its distribution within the nucleus may be. Other factors known to influence radiation effect such as oxygen tension and sulfydryl oxidation also will be briefly discussed, as well as evidence of disturbances in nuclear metabolism following irradiation.

Results of continuous exposure of bacteria to beta and of various species of higher plants to gamma radiation will be reported briefly.

3589 Consideration of the Relationship Between Chromosome Breakage and Mitotic Inhibition Induced by Ionizing Radiation. Arnold H. Sparrow. AECU-822, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Cells irradiated in mid to late prophase are known to show a high degree of mitotic inhibition. This is also a stage of very high sensitivity to radiation-induced chromosome breakage. Subsequent loss of chromatin resulting from fragmentation leads to the production of a secondary mitotic inhibition. Two distinct mechanisms of inhibition seem to be involved. The question then arises as to whether the two stem from a common initiating phenomenon. If they do, it should be possible to relate the mechanisms of primary inhibition and chromosome fragmentation. The following working hypothesis is proposed.

Ionizing radiations are known to depolymerize DNA and denature proteins. Either of these changes in the nucleoprotein complex comprising chromosomes (or genes) can be visualized as sufficient to inhibit self-reproduction of the complex. Further, such changes seem sufficient to presume increased susceptibility of the complex to destruction by enzymatic processes. Denatured proteins are known to be more susceptible to proteolysis, and alkaline phosphatase is known to attack only the partly depolymerized form of nucleic acids. The preventing of self-reproduction is synonymous with mitotic inhibition and breakdown of changed chromatin, through attack by physiological processes, with resultant chromosome breakage. Thus it appears that both

inhibition and breakage may be related to the same primary changes produced in the nucleoprotein by ionizing radiation. (auth)

3590 Difference in the Effects of X-Irradiation in Rat Embryos of Different Ages. James G. Wilson and John W. Karr. AECU-830, nd. 1p.

Pregnant rats were opened surgically on the 9th and 10th days postovulation and shielded with lead plates so as to permit direct irradiation of selected implantation sites without exposure of remaining implantation sites or the mother. Irradiated and nonirradiated embryos were removed 3 or 4 days later and prepared for histologic study.

Subsequent development was altered much more severely by x-irradiation on the 9th than on the 10th day of gestation. Exposure to 200 r on the 9th day usually resulted in the death of all embryos, whereas on the 10th day a dosage of 400 r was required to obtain a similar lethal effect. Sublethal dosages at either age caused specific malformations in the survivors, but to produce defects comparable to those produced by 50 r on the 9th day, it was necessary to use 200 r on the 10th day. In both instances the eye was the most common site of maldevelopment (anophthalmia and microphthalmia), the brain was often hypoplastic, and the heart, urinary tract, and brain were occasionally malformed. Situs inversus and malformation of the spinal cord, however, were noted only after irradiation on the 9th day.

Also more prevalent after the earlier exposure were abnormal growths of compact masses of nervous-like cells in the mesenchyme surrounding the brain. Although apparently of neural origin, these islands of aberrant tissue were growing independently of the neural tube.

3591 Quarterly Report August, September, October, 1949. Biological and Medical Divisions, Argonne National Laboratory. Austin M. Brues and Hermann Lisco. ANL-4360, nd. 139p.

Among the several reports included in this publication are the following: the influence of the spleen on hematopoietic recovery after irradiation injury; response of the shielded spleen in adrenelectomized mice; comparison of the 30-day LD_{50} in mice following total-body x-irradiation and intravenously administered radon; effect of irradiation on a transplantable mouse lymphosarcoma; the effect of cysteine on the peripheral blood and body weight of the irradiated rat; quantitative aspects of the protective action of cysteine against x-irradiation; influence of cysteine on the radiosensitivity of Walker rat carcinoma-256; in vivo studies of propulsive motility of the gastrointestinal tract following irradiation.

Statistical analysis of serial blood counts on human subjects; effect of variation in dosage rate of x-rays upon survival in rabbits; cocarcinogenesis of methylcholoanthrene and beta emitters; studies of the uptake of $C^{14}O_2$ in yeasts; the effect of prolonged cold treatment on x-rayed cells; inhibition of cellular respiration (sea urchin sperm and bacteria) by x-irradiated water; the resistance of ameba respiration to the action of x-irradiation; comparison of the effects of x-irradiation on mouse tumor implants at 29°C and at −78°C; physical endurance of rats following total-body x-irradiation; effect of citrate salts and other chemical factors on the distribution and excretion of beryllium; and effect of x-irradiation on enteric cholera and coproantibody response in the guinea pig.

BIOLOGY AND MEDICINE

3592 The Effect of Acute Doses of X-Irradiation on the Splenic and Thymic Weight of CF-1 Female Mice. Robert E. Carter, Payne S. Harris, and James T. Brennan. LA-1075, Mar. 7, 1950. 8p.

A high correlation is obtained between total x-radiation received during a single exposure and loss of weight of the spleen and thymus of female mice. A 250-kv peak x-ray machine was used with a 3.9-mm Cu filter in addition to the inherent filtration of the tube (equivalent to approximately 2.00 mm of Al). The exposure rate was 14 r/min. Curves of the log of the total dosage (in roentgens) and the per cent weight loss of the thymus and spleen are linear on a semilog graph. The use of splenic and thymic weight change as a means of biologically comparing various ionizing radiations is suggested. 15 references.

3593 Changes in the Composition of the Blood Plasma of the Guinea Pig During the Acute Radiation Syndrome. Henry I. Kohn. ORNL-464, Apr. 14, 1950. 12p.

The plasma of the guinea pig was studied during the 8 days following a single total-body exposure to 250 kvp x-rays. The changes came in two phases with respect to time, the first phase beginning within 1 day of exposure, the second phase beginning about 3 or 4 days later and corresponding to the time when the first serious symptoms were noted. The changes after 200 r, the approximate LD_{50}, were smaller than after 600 r, but the patterns of change were alike. After 200 r, the following was observed. Glucose concentration rose 60 mg% during the first day and gradually returned to normal during the next 5 days. The nonprotein nitrogen was elevated by 10 mg% for 5 days. The albumin-globulin ratio rose from a normal of 3.1 to 4.5 during the first 2 days and returned to normal during the next 3 days. The rise was due to nonprotein material which could be rendered ineffective by extraction of the plasma with ether. The total protein level fell about 1 g% during the 5th to 7th days after exposure. The chloride concentration was elevated by as much as 50 mg% during the 3d to 5th days. Cholesterol was elevated by 20 mg% during the 4th and 5th days. A peculiar, transient syndrome was also noted during the first hour or two immediately following exposure, especially after 600 r, whose signs were abnormal posture, labored respiration, and lacrimation. 16 references. (auth)

3594 Alkaline Phosphatase Activity and Desoxyribonucleic Acid. M. H. Ross and J. O. Ely. J. Cellular Comp. Physiol. 34, 71-95(1949) Aug.

Sodium desoxyribonucleate preparations of various molecular weights were obtained by treatment with heat, H_2O_2, sonic vibration, HCl, desoxyribonucleic acid depolymerase, and the x-irradiation of 15 ml of a 1.04% solution, 5 mm in depth, at 2,173 r/min, giving a total dose of 100,000 r with a 0.002-mm Al filter. This is a part of an extensive study which the authors conclude showed the presence of alkaline phosphatase which hydrolyzed both depolymerized and highly polymerized forms of desoxyribonucleic acid; the highly polymerized forms occurred in such low concentrations that its activity had not been previously detected.

BIOLOGY AND MEDICINE

3595 Differential X-ray Sensitivity of Tradescantia Chromosomes During the Mitotic Cycle. Charles J. Bishop. Genetics 35, 175-87(1950) Mar.

The results of an investigation to determine the stage and range of sensitivity in the mitotic divisions of pollen grains of Tradescantia are described. A direct analysis of chromosome alterations was performed. X-radiations were delivered at 160 kv through inherent filtration at a target distance of about 65 cm; the dosage used was 250 r. Both before and after x-ray treatment the plants were kept in the greenhouse, remaining there until the buds to be analyzed were opened. The x-ray effects were analyzed at the metaphase stage of the pollen division from slides prepared over a period extending from the second to the seventh day after treatment. The data obtained indicate there was a period of low sensitivity during the postmitotic resting stage, and two points of high sensitivity, one at the time of chromosome doubling during the prophase of the pollen tube division and the other at metaphase-anaphase of the pollen grain division, the latter being the greater of the two. It is suggested that the prophase peak of chromosome sensitivity to x-ray breakage occurred about 3 days after actual chromosome doubling. It is also suggested that the metaphase-anaphase peak of sensitivity was due to the prevention of restitution by (a) factors of longitudinal tension induced with the chromonema by changes during the spiralization cycle and later by the spindle mechanism, and (b) the chromosome matrix which reduced fragment movement after breakage and separation. X-ray breaks indiced during the stages before the prophase of the generative nucleus division were shown to remain open and to be capable of sister chromatid reunion when the chromosome became double, which was as long as 2 days after the x-ray treatment. 24 references.

3596 Hemopoietic Function and Irradiation of the Pyloric-Duodenal Tract. Part I. Behavior of Erythropenia and of Digestive Leucocytosis in Normal Persons Subjected to Irradiation of the Pyloric-Duodenal Tract. Cesare Tripodo and Giuseppe del Buono. Haematologica 31, 693-710(1948)(in Italian).

A total of 11 normal persons was irradiated in the region of the pyloric-duodenal tract with three doses of 200 r, delivered by a 160-kv x-ray machine at a target distance of 30 cm and through an aluminum filter. The irradiation was spaced at intervals of 3 days for a total dose of 600 r. No distinct changes in the number of erythrocytes, in the leucocyte picture, in the number of platelets, in the sedimentation rate of the erythrocytes, or in the behavior of the leukocyte digestive reaction to the administration of a meat diet were noted; a decrease in the normal erythropenic digestive reaction, however, was noted. Confirmation that digestive erythropenia represents the initial mechanism that in normal conditions determines and regulates physiological erythropoiesis has been obtained.

3597 A Modified Technique for Counting Blood Platelets. Ellen Skirmont, Edna K. Marks, and Leon O. Jacobson. Am. J. Med. Technol. 15, 86-9(1949) Mar.

A complete description is given of the method used in making platelet counts in a study of dosage tolerance levels in radiation laboratory personnel, where the counts could not be made immediately after blood collection. Sample results of 8 readings from a total of 200 comparative readings are given, and the authors conclude that these are directly comparable to those counts obtained by the direct method.

BIOLOGY AND MEDICINE

3598 Ocular Lesions Induced by Acute Exposure of the Whole Body of Newborn Mice to Roentgen Radiation. Egon Lorenz and Thelma B. Dunn. Arch. Ophthalmology 43, 742-9(1950) Apr.

Twenty-four male and 32 female mice of strain A were given at birth a single whole-body dose of 400 r delivered by a 186-kv machine at 50 cm target distance. The experiment was terminated 12 months later. Seventeen males and 22 females survived; all showed lesions in one or both eyes. These lesions consisted of opacity of the lens, partial opacity and vascularization of the cornea, and atrophy of the retina, which was only a small fraction of its normal thickness. The difference in radiosensitivity of the eye of young and that of old animals is discussed. (auth)

3599 On the Existence of Buffers, Inhibitors of the Radiation Detoxification of Strychnine. Jean Loiseleur and Georges Velley. Compt. rend. 230, 784-6(1950) Feb. 20 (in French).

An experimental coefficient of radiosensitivity defined by the number of mg difference between the limiting tolerance dose of strychnine in an 0.5% sterile water solution and this limiting dose of an 0.5% sterile water solution of strychnine irradiated with 10^6 r of K rays from Mo was determined for water and strychnine solutions containing NaCl, $NaNO_3$, $Fe_2(SO_4)_3$, $SnCl_4$, and saccharose (all nonacceptors of oxygen), and $NaNO_2$, $FeSO_4$, $SnCl_2$, glucose, A ascorbine, and hydroquinone (all oxygen acceptors). The oxygen acceptors exerted a protective effect on the mouse toxic dose, expressed in terms of the coefficient of radiosensibility, of 77 to 88%. The authors conclude that the radiation detoxification is a result of activated oxygen, which is dissolved in the solution, combining with the strychnine to form a less toxic molecule, and the buffers act by removing this oxygen.

3600 Positive Cephalin-Cholesterol Flocculation Test in X-Ray Workers. Nell Butler and James F. Crenshaw. Am. J. Med. Technol. 14, 255-8(1948) Sept.

Carefully controlled experiments are described, testing cephalin-cholesterol serum flocculation in 28 x-ray workers who had been exposed for periods ranging between 4 months and 20 years. The data are presented in a table which correlates exposure time, age, sex, gastrointestinal symptoms, jaundice, liver tenderness, liver enlargement, and splenic enlargement with the results of 24-hr cephalin and 48-hr cholesterol flocculation tests. The authors conclude that at least 82% show some positive tests and suggest that this may be a measure of slight changes in liver function due to roentgen irradiation.

3601 Radiation Scoliosis: An Experimental Study. Alvin M. Arkin and Norman Simon. J. Bone Joint Surg. 32A, 396-401(1950) Apr.

Examples are presented concerning the production of scolioses in rabbits by the direct action of radiation upon the spinal epiphyseal plates. A radon seed, containing 0.6 mc of radon, was placed adjacent to an intervertebral space in

the lumbar spine of a rabbit in one case, and the radiation caused a suppression of the growth of the epiphysis on the side nearer the seed; a few months later, growth of the spine manifested asymmetry by a wedging of the vertebrae adjacent to the source of radiation. When radon seeds of 0.6 mc were placed opposite the middle of a vertebral body, or when 0.2-mc seeds were placed near one epiphyseal plate, no discernible wedging was noted. Growth suppression of the vertebral epiphyseal plate near the 0.6-mc seed was induced by a dose of about 2,700 r; the epiphysis next above the seed grew normally although it received a dose of 300 r. Similar asymmetrical growth arrest was effected by the use of an x-ray beam directed to one side of the spine; the radiations were delivered by a 140-kv machine through a filtration of 0.25 mm of Cu and 1 mm of Al at a target distance of 30 cm for an epiphyseal dose of 1,000 r; wedging appeared 7 weeks later. It is concluded that a single dose of 1,000 r is required to produce definite wedging in the spines of young rabbits.

3602 Some Histological Effects of Carbon 14 on the Leaves of Certain Medicinal Plants. J. M. Beal. Botan. Gaz. 110, 600-4(1949) June.

A cytological description is given of the leaves of Digitalis purpurea, Digitalis lanata, Papaver somniferum, Nicotiana rustica, and Atropa belladonna which had been grown in a $C^{14}O_2$ atmosphere for various periods of time. The atmospheres contained 400, 900, and 1,400 μc of the $C^{14}O_2$ in the various experiments; the authors conclude on the basis of these observations that the C^{14} does not effect the protoplasm with which it comes in contact, but that the differences noted are all alterations in the pattern of tissue differentiation.

3603 The Development of a Destructor for Processing Solid Combustible Radioactively Contaminated Waste. F. T. Crego, W. B. Moen, C. J. Sullivan, and A. Muller. ARSC-31, Apr. 1950. 56p.

The design, construction, and testing of an experimental destructor for processing solid combustible waste contaminated with radioactive materials is described and discussed. Three units have been built, and the factors and considerations leading to the final design are outlined. Oxygen has been used for combustion to minimize the volume of combustion products and to accelerate the burning rate. A burning rate of approximately 20 lb/hr of cellulose has been realized with an oxygen input of 400 cfh, with efficiency of oxygen utilization considerably exceeding early estimates. Methods for processing the gaseous combustion products of the destructor, in order to dead-end these products by absorption and condensation, are discussed. A sulfur afterburner has been chosen as the safest and most effective means of converting residual oxygen to absorbable sulfur dioxide. (auth)

3604 Health Problems of X-ray Shoe Fitting. William G. Fredrick and Ralph G. Smith. Am. Ind. Hyg. Assoc. Quart. 9, 89-93(1948) Dec.

A study of 43 x-ray shoe-fitting installations was performed in order to determine conditions under which shoes could be fitted with safety to both customers and employees with regard to the tolerance dose of radiation. The results of tests with sample machines in use in terms of the roentgens delivered, intensities, amounts of stray radiation, amount of radiation needed to produce a satisfactory image, and controls are presented. The authors conclude that the primary beam intensity delivered by a 50-kv machine should be limited to 12 r/min with a filtration of 1 mm of Al, limiting exposures to 5 sec each, not more than 5 times a day, not more than a total of 20 exposures a year, so that the radiation will not exceed 0.1 r/day.

BIOLOGY AND MEDICINE

3605 Radioactivity — A New Factor in Water Works Practice. Arthur E. Gorman. J. Am. Water Works Assoc. 41, 1053-60(1949) Dec.

The author briefly discusses the different types of radiation and their effects on living tissue. He then describes work now in progress to safeguard water supplies from contamination by radioactive wastes and to establish tolerance limits for concentrations of activity in air and water. It is concluded that water works and public-health officials will have to acquaint themselves with the fundamentals of nuclear physics and with the techniques of radiation measurements in order to deal with the problem of radioactive contamination in the future.

3606 Relation Between the Radiation Dose Tolerated by the Skin and the Distance of the Radiant Source from the Skin. J. Klumpar. Acta Radiol. 31, 223-2(1949).

The surface dosage of γ rays required to produce a certain degree of skin reaction by radium therapy depends on the distance between the radiophore and the surface of the skin; at small distances a five times greater surface dose may be applied than at greater distances. On the basis of empirically determined application times and of graphs showing the dependence of the intensity of radiation on distance, it could be demonstrated that the depth dose 4 mm below the surface was responsible for the reaction of the skin. In all cases, with distances of 0.25 to 0.28 cm, the same degree of reaction was obtained if the dose 4 mm below the surface was 3,500 $\pm$ 600 r. It is concluded that dosage figures obtained with ionization chambers of an external diameter of 7 to 8 mm are convenient for all types of surface applicators.

3607 Research on the Disposal of Radioactive Wastes. O. R. Placak and R. J. Morton. J. Am. Water Works Assoc. 42, 135-42(1950) Feb.

The problems involved in radioactive waste disposal are discussed in general terms. The natural activities of several water sources are tabulated, and it is noted that natural activities are in some cases higher than the activity in Clinch River, below the Oak Ridge plant. The author then describes work now in progress to determine maximum permissible concentrations of radioactive materials, and the maximum permissible concentrations of various materials in various organs of the human body are tabulated. The general program that has been set up by several agencies to study the problem of radioactive waste disposal is described.

3608 An Unusual Hazard Associated with Handling of $C^{14}BaCO_3$. C. K. Claycomb, Tyra T. Hutchens, and J. T. Van Bruggen. University of Oregon, nd. 3p. (AEC File No. NP-1340.)

In the weighing of a sample of $BaC^{14}O_3$, difficulty was experienced with electrostatic charges on the sample and

BIOLOGY AND MEDICINE

equipment. The practice since has been to have all equipment at ground potential by working on a grounded stainless-steel table top. The use of cloth gloves rather than rubber gloves at certain stages of operation has also reduced the hazard.

3609 Adenocarcinoma of the Uterine Corpus. Diagnostic and Therapeutic Considerations. Léopold and Charles Mayer. Acta. Chirurgica Belg. 49, 199-211 (1950) Feb (in French).

An extensive discussion is presented of the pathological anatomy, histopathology, classification, methods and reliabilities of diagnostics, and therapy of uterine corpus adenocarcinoma. A review is given of the results of various authors on the use of x- and radium irradiation as an adjunct to surgical treatment; radium irradiation of 2,000 to 4,000 mg-hr and x-irradiation of 300 r delivered by a 200-kv machine through four ports were the approximate average postoperative radiation therapy used.

3610 Basic Research in the Field of Blood Disorders. Roy R. Kracke. Am. J. Pharm. 121, 56-63(1949) Feb.

This is a general review of the state of present work in blood disorders, such as anemias and leukemias; mentioned are: P^{32} therapy for acute leukemia and polycythemia vera and the possible use of short-life radioisotopes for further therapy; protamine sulfate and toluidine blue therapy for hyperheparinemia from unknown causes and for thrombocytopenic purpura; and the use of BAL for heavy-metal poisoning. The author indicates that the use of radioisotopes is limited and gives doubtful or poor results. 21 references.

3611 Carcinogens and Carcinogenesis. W. C. Hueper. Am. J. Med. 8, 355-71(1950) Mar.

This is an extensive survey of known and suggested carcinogenic agents, including a discussion of beryllium, radioactive substances, their properties as carcinogens, incidence, and exposure periods.

3612 Evaluation of Hormonal and Radiation Therapy in Cases of Functional Sterility and Secondary Amenorrhea. Preliminary Report. Rita S. Finkler. Am. J. Obstet. Gynecol. 58, 559-64(1949) Sept.

This is a preliminary evaluation of the relative merits of endocrine and radiation therapy in a series of 130 cases of functional sterility and 60 cases of secondary amenorrhea in women of a younger age group. The radiation was delivered to the pituitary and ovaries by a 200-kv machine with a 0.6-mm Cu and 1-mm Al filter, at a target-skin distance of 50 cm, in four doses over a 2-week period, giving a total organ dose of 80 r. In cases of functional sterility, conception took place in 34.2% of the patients treated with hormones and in 35.2% of those treated with radiation; in secondary amenorrhea, menstruation was established in 40.6% of those receiving hormone therapy and in 46.4% of those receiving radiation therapy. The author concludes that the radiation appears to be the therapy of choice because of the higher percentage of success, the more rapid response, and economy, but mentions that great care must be taken in accurate diagnosis and in proper selection of cases for this therapy. 26 references.

BIOLOGY AND MEDICINE

3613 Implanter for Radon Seeds for Use with the McCarthy Foroblique Pan-Endoscope. J. Robt. Rinker. J. Urol. 62, 91(1949) July 1.

An implanter of radon seeds is described which has been modified so that the shaft is rigid and can be used with the McCarthy Foroblique Pan-Endoscope; a few notes on the technique of its use are given.

3614 Malignant Melanoma of the Skin. Report of 341 Cases Treated during the Years 1929-1943. B. Sylvén. Acta Radiol. 32, 33-59(1949).

This is an analysis of the results of treatment of 341 cases of malignant melonoma of the skin at Radiumhemmet, Stockholm, by combined surgery and irradiation. The overall five-year survival rate was 34.6%.

3615 Meeting of the Manchester Medical Society, Feb. 1, 1950. Brit. Med. J., No. 4657, 839-40(1950) Apr. 8.

The following paper was presented at this meeting: The Treatment of Thyroid Cancer by Radioactive Iodine, J. Ralston Paterson. The therapeutic use of radioiodine in thyroid cases is discussed. The author considers the use of the isotope as one of the lesser therapeutic advances; after oral introduction, a portion of the I^{131} is excreted in the urine unchanged, while the rest is concentrated in the thyroid. Seventeen cases of thyroid cancer were examined for isotope "pickup"; only two showed a sufficient "pickup" to warrant use of this therapy; other cases were treated by x-rays or surgery.

3616 Preliminary Studies of X-Ray Contact Therapy. José P. Uslenghi, Frederico Vierheller, and José Luis Molinari. Anales Inst. Municipal Radiol. Fisioterapia 1948, p. 9-14.

The theoretical and practical aspects of x-ray contact therapy are discussed. The geometry of the actual volume of tissue irradiated by a particular source is demonstrated by inserting a photographic film in a block of paraffin, the latter then being given a contact dose. The size and location of the emitting spot in the x-ray tube are determined by means of a Pb pinhole camera.

3617 Radiation Therapy in Peptic Ulcer: An Analysis of Results. William E. Ricketts, Walter Lincoln Palmer, Joseph B. Kirsner, and Anna Hamann. Gastroenterology 11, 789-806(1948) Dec.

An analysis of 800 cases of peptic ulcer treated with roentgen irradiation is presented in terms of the depression of gastric acidity, cures obtained, the effect on histamine secretion, the interval between radiation and the occurrence of achlorhydria, and the duration of achlorhydria in duodenal, jejunal, and gastric ulcers. Irradiation was delivered by a 200-kv machine, through a filter of 1 mm Cu and 1 mm Al with an intensity of 33 r in air/min at a focal distance of 50 cm, through a left hypochondrium and a left costo-lumbar port, using four types of dosage: 5 anterior and 5 posterior ports alternating daily, giving a total fundus and corpus dose of 1,600 to 2,500 r; 5 to 8 doses/port in 11 to 14 days, giving a depth dose of 1,600 r; 5 doses to each port in 11 to 12 days, giving a depth dose of 1,000 to 1,500 r; 3 doses to each port in 6 to 7 days, giving a depth dose of 600 to 1,000 r. The authors conclude that: irradiation therapy is effective

in peptic ulcer; there is no correlation between the effect of the treatment and the age of the patient or disease duration previous to the treatment; postirradiation achlorhydria is more common in gastric ulcer than in the other types; achlorhydria varies in duration from a few days to 8 years; irradiation achlorhydria does not produce symptoms; achlorhydria of 3 months duration produces healing of the ulcer; the incidence of recurrence is lowered by irradiation. 62 references.

3618 Radiation Therapy in Peptic Ulcer: A Study of Selected Cases. William E. Ricketts, Walter Lincoln Palmer, Joseph B. Kirsner, and Anna Hamann. Gastroenterology 11, 807-17(1948) Dec.

A complete detailed analysis of five cases of chronic peptic ulcer treated by roentgen irradiation is presented in order to focus attention on occasional dramatic effects and failures of the treatment. Irradiation in cases of gastric and duodenal ulcer was delivered, following the techniques presented in a previous paper [Gastroenterology 11, 789(1948)], giving total depth doses of 930 to 3,900 r in 6 to 16 days. The authors conclude that irradiation of acid-secreting portions of the stomach may produce a profound depression of the gastric secretion persisting for variable periods of time and that the course of the ulcer depends on the degree and duration of secretory depression.

3619 Radioiodotherapeusis. Robert H. Williams, Beverly T. Towery, Herbert Jaffe, Walter F. Rogers, Jr., and Rene Tagnon. Am. J. Med. 7, 702-17(1949) Dec.

A total of 111 patients was treated with radioiodine for thyrotoxicosis, nontoxic nodular goiter, or malignant adenoma. In 92 of 97 patients treated with I^{131}, a remission was produced which has persisted; the average number of doses per patient was 2.2, and most of the patients became euthyroid in 6 months after receiving approximately 225 μc/g of thyroid tissue. An average total of 8 mc was required for thyrotoxic patients with diffuse hyperplasia of the thyroid and those previously thyroidectomized. The results of the treatment with I^{130} are also favorable. Some complications observed were persistent myxedema in 3 cases and transient hypothyroidism in 16 others. Other factors will be discussed in another paper. (auth)

3620 Secondary Radiation and the End Result. John J. Russell. X-Ray Technician 20, 85-90(1948) Sept.

This is a brief review of secondary radiations in x-ray use, including description, discussion, and evaluation of four types of diaphragm (the Potter-Bucky diaphragm, the Schonander-Lysholm stationary all-metal grid diaphragm, cones and extension cylinders, and lead aperture diaphragms).

3621 Some Implications of Atomic Energy in Physical Medicine. John Z. Bowers. Arch. Phys. Med. 30, 400-4(1949) June.

This is a general review article of the use of radiation in medicine, with special reference to radioactive isotopes such as radiosodium, radioiodine, radiophosphorus, and radioactive cobalt as used in label studies and for therapeutic purposes.

BIOLOGY AND MEDICINE

3622 Thyroid Diseases. Earle M. Chapman. J. South Carolina Med. Assoc. 46, 107-14(1950) Apr.

This article is an amplification of one which appeared in McGill Med. J. 18, 71(1949) and was listed in Nuclear Science Abstracts as Abstract No. 2-2217.

3623 Transitional Cell Carcinoma of the Paranasal Sinuses. LeRoy A. Schall and David W. Brewer. Ann. Otol., Rhinol. & Laryngol. 58, 381-93(1949) June.

Complete case reports of five cases of transitional cell carcinoma of the paranasal sinuses are given. Using surgery as a supplemental treatment when necessary, the patients all received x-ray therapy, with radiation delivered to the region of the lesions in doses of 2,000 to 6,200 r, fractionated in amounts depending on the progress of the disease and the locality of the lesion, with total doses ranging between 4,100 and 12,700 r. The problems of diagnosis and therapy are discussed; the radiation seemed to give satisfactory results.

3624 Value of Radioisotopes in Medicine. Albert H. Holland, Jr. Pharmacy International 3, 11, 26-27, 50, 52-53(1949) Mar.

A general article is presented on the radioisotopic applications to the field of medicine. Such topics as the fundamental concept of radioactivity, isotopes and isotope production, medical aspects of radioisotopes (treatment of polycythemia vera, leukemia, hyperthyroidism, and certain malignancies), and the particular applications and characteristics of such isotopes as radiogold, radioiodine, and radiophosphorus are presented under separate headings. One of the advantages accomplished by the therapeutic application of radiophosphorus is the elimination of radiation sickness. The availability of the isotopes and possible distribution by the pharmacist are also discussed; the author contemplates future synthesis and packaging of compounds incorporating isotopes by pharmaceutical companies for sale to physicians.

3625 X-ray Therapy in Interstitial and Pigmentary Keratitis. W. G. Magrane. North Am. Veterinarian 29, 582-4(1948) Sept.

Permanent cures were obtained of 15 cases of interstitial keratitis in dogs (pigmentation was checked or disappeared) by radiotherapeutic x-ray doses of 140 r repeated at 4- to 5-day intervals for 4 to 5 treatments with lead shielding for the nonirradiated eye. The radiation in conjunction with riboflavin and vitamin A dosage is considered in terms of its application to this condition in man.

3626 A Recommended Method for the Measurement of the Acute Toxicity of a Substance Administered by Intraperitoneal Injection. Elliott A. Maynard. AECU-743, nd. 6p.

In the method described, the 24-hr LD_{50} dose (the dose to kill 50%) is determined for at least three species of animals. By the method of Bliss (Quart. J. Pharm. & Pharmacol. 11, 192(1938) Apr.-June), the dosage response curve is obtained by plotting probit kill against the logarithm of the dose. The sigmoid curve is thus transformed to a straight line from which is estimated the LD_{50} dose. Data are given for NaF. The LD_{50} dose for subcutaneous or intramuscular

routes of administration can be determined in the same manner as outlined for intraperitoneal injection.

3627 Bone and Tooth Lesions in the Rat Resulting from Ingestion and Intraperitoneal Administration of Beryllium Compounds. E. A. Maynard, W. L. Downs, and J. K. Scott. AECU-744, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Weanling rats fed a diet containing 8% beryllium sulfate or beryllium carbonate developed rachitic lesions of the bone within three weeks from the beginning of treatment. After removal of the beryllium compounds from the diet, the epiphyseal line and metaphysis slowly returned to normal. However, the original metaphysis (the "primary spongiosa") was not resorbed, as would be expected with Steenbock diet rickets, but remained at its original position in the shaft for approximately a year. A new zone of provisional ossification ("secondary spongiosa") appeared, and the long bones increased in length as expected. Beryllium (approximately 11 μg/g) was present in the bone 280 days after removal of beryllium compounds from the diet. Overgrowth of incisors occurred within two months after removal of beryllium sulfate from the diet.

Within a period of three weeks following the intraperitoneal administration of a single dose of beryllium carbonate, or oxide (3000 mg/kg body weight), there appeared zones of hyperossification in the areas of active bone growth. (auth)

3628 Character of Blood Changes in Acute Experimental Beryllium Poisoning. H. E. Stokinger, F. A. Smith, C. J. Spiegl, J. K. Scott, and C. A. Stroud. AECU-749, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Anemia has been a consistent finding in dogs and rats inhaling soluble beryllium salts even at concentrations (100 μg or less Be/m^3 of air) from which few or no other symptoms appear. One interesting aspect is that the anemia differs between the species in two respects. (1) Dogs showed a decrease in both RBC (2×10^6 mm^3) and hemoglobin (2 g %), but little change in mean corpuscular hemoglobin concentration after 8 weeks of exposure; rats showed a similar decrease in RBC, a rise in mean corpuscular hemoglobin, but no change in hemoglobin concentration, developing an anemia in character resembling a macrocytic, hyperchromic type. (2) Response to folic acid (FA) differed. FA had no effect on anemia in the dogs, whereas in rats it prevented the anemia entirely and appeared to influence favorably five other criteria of beryllium poisoning as well.

Indications are that the anemia may be produced by beryllium interfering with the maturation of reticulocytes as evidenced by low circulating reticulocyte counts or possibly by toxic injury to the liver as evidenced by the development of hypoalbuminemia, hyperglobulinemia, and a doubtful effect of Vitamin B-12 (in dogs). Thus the anemia may be related to an over-all disturbance in nitrogen metabolism, one of the dominant findings in beryllium poisoning.

The foregoing findings were made in 8 dogs and 40 rats, each divided into equal groups of FA-treated and control animals. Dogs were given FA orally by capsule in the amounts of 10 mg/day in two divided doses; rats, 2 mg/day.

Records of weight and mortality were kept on both species, as well as records of daily food intake. On a weekly basis, blood counts were made in quadruplicate on the dogs, only terminally in the rats. Biochemical determinations included total serum protein, albumin and globulin, serum-alkaline phosphatase, serum-dilution turbidity tests, phospholipid, and cholesterol of whole red cell. Exposure of the animals occurred 6 hr daily, 5 days/week for 60 days to $BeSO_4 \cdot 6H_2O$ mist at a concentration of 3.6 mg/m^3.

3629 Dimercaprol and the Biliary Excretion of Lead in Rabbits. Michael Ginsburg and Miles Weatherall. Brit. J. Pharmacol. 4, 274-6(1949) Sept.

The effect of BAL doses of 4.0 to 12.5 mg/kg on the fate of lead in five pentobarbitone-anesthetized rabbits was determined with the use of lead acetate labeled with Pb^{212} (about 200 μc) which was administered intravenously; bile collections were made for 1 hr; after this period the animals were sacrificed, and tissue samples were taken for lead determinations. The authors conclude that BAL increases the excretion of lead in the bile of anesthetized rabbits.

3630 The Effect of Dimercaprol on Lead Poisoning in Mice. A. B. Anderson. Brit. J. Pharmacol. 4, 348-50(1949) Dec.

Lead acetate marked with a tracer of Pb^{210} was fed with a low-calcium diet to 38 mice in three groups (one receiving the diet alone, the second receiving lead and BAL simultaneously, and the third receiving lead followed by BAL); after varying periods the lead content of the whole animal was determined by chemical analysis and β-radiation counts. The results are tabulated and show that the lead content of mice which had received 50 mg of BAL/kg daily and lead simultaneously for 10 to 14 days averaged 0.48 mg of Pb per 100 g of mouse which was significantly lower than that of controls which averaged 1 mg of Pb per 100 g of mouse; when lead alone was administered for 8 to 10 days, subsequent treatment with BAL during a recovery period of 1 to 2 weeks had no significant effect on the final lead content. The author concludes that these results provide no indications for the use of BAL in the treatment of chronic lead poisoning.

3631 The Effects of Dimercaprol and Parathyroid Extract on the Subacute Distribution of Lead (Acetate) in Rabbits. K. R. Adam, M. Ginsburg, and M. Weatherall. Brit. J. Pharmacol. 4, 351-8(1949) Dec.

Following a technique previously described [Ginsburg and Weatherall, Brit. J. Pharmacol. 3, 223(1948)], the distribution of lead in the tissues of rabbits 13 and 21 days after the intravenous administration of lead acetate (2.07 mg/kg) was studied by the use of Pb^{210}. The animals were treated with BAL or parathyroid extract, or both, for several days during the week before they were sacrificed; the results are completely tabulated, discussed, and histographed in terms of lead content of excreta, blood, fresh tissues from all parts of the body, and total content of several organs. The authors conclude that the treatment with BAL and parathyroid extract appears to have no useful effect in rabbits subacutely poisoned with lead, but confirmation of this finding in other species is desirable.

BIOLOGY AND MEDICINE

3632 Observations on the Causes of Dyspnea in Chronic Pulmonary Granulomatosis in Beryllium Workers. Robert A. Bruce, Frank W. Lovejoy, Jr., George B. Brothers, and Tulio Velasquez. Am. Rev. Tuberc. 59, 364-90(1949) Apr.

The resting and exercise measurements of pulmonary and cardiovascular function in six patients with chronic pulmonary granulomatosis due to beryllium inhalation (occupational and neighborhood air contamination) are presented in detail in relation to the evolution of the disorder and its complications. Extensive data on the patients are presented and discussed in terms of lung volume, pulmonary efficiency in relation to work, relation of ventilation and arterial saturation to the alveolar gradient, maximum breathing capacity, alveolar pressure, physiological dead spaces, cardiovascular measurements at rest, exercise responses, and the effects of congestive heart failure in one patient. 24 references.

3633 Some Effects of Thiol-Compounds on Tumour Induction by Carcinogenic Hydrocarbons. H. G. Crabtree. Brit. J. Cancer 2, 281-9(1948) Sept.

This is an extension of work, based on the hypothesis that S-metabolism is concerned in the initial stages of carcinogenic action, with a series of SH-containing substances applied to the skin of mice in conjunction with 3:4-benzpyrene, methylcholanthrene, and 1:2:5:6:-dibenzanthracene. The mice were divided into 19 groups of 30 mice each and submitted to dissolved carcinogens by brushing on the skin until 90% of the controls had produced tumors; the effect on tumor growth, regression, and induction time of monothiols and dithiols, including BAL, was tested. The details of the results are given and discussed with special reference to the mechanisms involved in their action. The author concludes that: all the monothiols tested had no effect on the carcinogenisis; toluene-3:4-dithiol was too toxic for the conditions of the experiment; BAL is definitely anticarcinogenic, though in less degree than simple S-metabolism inhibitors. Some other work is also reviewed in relation to the problem.

3634 The Minor Role of the Non-Hepatic Tissues in Plasma Protein Synthesis as Observed with the Aid of Lysine-ϵ-C^{14}. C. G. Bly, L. L. Miller, and W. F. Bale. AECU-745, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The surviving carcass of normal Wistar-strain rats, posterior to the second lumbar vertebra, with or without kidneys, has been found to synthesize plasma globulins from a complete mixture of amino acids containing DL-lysine-ϵ-C^{14}. Although the amino acids are rapidly removed from the continuously perfused heparinized blood, the total plasma protein synthesized amounts to 5 to 20% of that synthesized by the liver from the same amino acid mixture in the same time. Weight for weight, the liver is at least 200 times as active as the carcass in plasma protein synthesis. On a relative basis, the skeletal muscle, kidney, and testes have produced far more tissue protein than plasma protein. The liver, on the contrary, synthesizes an amount of plasma protein of the same order of magnitude as that of the liver-tissue protein.

BIOLOGY AND MEDICINE

3635 Plasma Protein Synthesis as Observed in a Direct Study of the Liver with the Aid of Lysine-ϵ-C^{14}. L. L. Miller, C. G. Bly, M. L. Watson, and W. F. Bale. AECU-746, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

A direct study of the isolated surviving rat liver in vitro yields evidence that the liver synthesizes all plasma albumin and fibrinogen and at least 80% of the plasma globulin fraction. Livers are obtained from adult Wistar-strain rats and rapidly incorporated in a simple system for the continuous perfusion of isolated intact organs with heparinized oxygenated blood at known temperature and pressure. With the aid of lysine-ϵ-C^{14}, the liver is found to respond to variations in amino acid substrate in a fashion qualitatively and quantitatively analogous to that of the intact animal. Very little plasma protein is synthesized when the liver is offered only lysine-ϵ-C^{14} in the perfusing blood. The addition of the essential amino acids enhances plasma protein synthesis tenfold. Protein synthesis is further increased by the simultaneous addition of the nonessential amino acids. The addition of extra glucose to the blood slows the disappearance of the free amino acids, but enhances not only the plasma protein production, but also the apparent deposition of new liver-tissue protein. When under optimal conditions for plasma protein synthesis DL-lysine-ϵ-C^{14} is replaced by D-lysine-ϵ-C^{14}, protein synthesis is less than 10% of that seen with the DL-lysine-ϵ-C^{14}. A comparison of the rat liver with the surviving posterior half of the rat carcass, including gonads and kidneys, demonstrates the dominant role of the liver in plasma protein synthesis.

3636 The Effect of Thiouracil on the Uptake of Radioactive Iodine by the Thyroid Gland of Summer Frogs (Rana pipiens). Samuel A. Matthews. AECU-750, nd. 21p.

The thyroid gland of summer frogs (Rana pipiens) takes up about 3% of an injected tracer dose of I^{131} in 24 hr. The amount continues to increase up to 48 hr after injection, when between 4 and 5% of the injected iodine is present in the gland. Autographs show that this material enters the colloid and becomes organically bound there within 1 hr after injection. The thyroid of animals treated daily with 5 mg of thiouracil for 5 days or more takes up only one-fifth as much iodine from an injected dose as does the thyroid of control animals. Some of this is also organically bound and appears in autographs of the gland. 18 references. (auth)

3637 Blood Volume of the Rat Measured by the Tagged-Erythrocyte Dilution Method. L. M. Sharpe, G. G. Culbreth, and J. R. Klein. AECU-775, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Male rats of the Sprague-Dawley strain, weighing from 260 to 340 g, were injected, via the superficial epigastric vein, with 0.5 ml of fresh rat blood, the cells of which had been tagged with Fe^{59}. After 1 to 2 hr the animals were again anesthetized and bled maximally from the aorta. From the radioactivities of donor and recipients blood, the average blood cell volume and its standard deviation were calculated to be 2.35 ± 0.18 ml/100 g of body weight. The corresponding average blood volume and its deviation, esti-

mated from the cell volumes and hematocrit, were 4.83 ± 0.31 ml/100 g. The blood volume found is markedly less than most derived from plasma-labeling, but agrees well with that found in another strain of rat [Berlin et al, Proc. Soc. Exptl. Biol. Med., 71, (1949)]. (auth)

3638 Phosphate Turnover in the Liver in Alloxan Diabetes. Jacob Sacks and Barbara Damast. AECU-776, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The effect of alloxan diabetes on the partition of the acid-soluble phosphorus compounds of liver and on their turnover rates has been studied in rats of the Sprague-Dawley strain. The tracer experiments were carried out several weeks after the administration of the alloxan, when the animals showed marked hyperglycemia, polyuria, and glycosuria. They were not losing weight. Access to food and water was allowed up to the time of injection of the tracer phosphate, which was given subcutaneously.

The inorganic phosphate content of the liver in these animals was about 50% higher than the normal range. The ATP-ADP and glucose-1-phosphate contents were reduced below normal. In the tracer experiments it was found that the P^{32} was removed from the plasma at a much greater initial rate than in normal animals. In the first few hours after the injection of the tracer phosphate, the relative specific activity of the P of the glucose-1-phosphate fraction was higher than that of the labile P of the ATP-ADP. This is the reverse of the situation found previously in the normal animal.

3639 Determination of Circulating Red Cell Volume by Radioactive Chromium. Seymour J. Gray and Kenneth Sterling. AECU-778, nd. 10p.

When Cr^{51} is added to blood in vitro as $Na_2Cr^{51}O_4$, it is taken up avidly by the red cells, which retain their radioactivity without significant loss for periods of 1 day or more after injection. A method for determining the circulating red cell volume is described in which the radioactivity dosage required is well within the tolerance limits for human use. Determinations made with 5 dogs were in good agreement with the actual volumetric measurement of the hemorrhage or transfusion with a difference of 5.3% or less.

3640 Distribution of Labeled Carbon in the Sugars and Alanine of Sunflower Leaves after Exposure to $C^{14}O_2$ in the Light and Dark. Martin Gibbs. AECU-781, nd. 3p.

The document is in abstract form; it is reproduced below in its entirety.

The rate at which assimilated carbon dioxide is distributed in the carbon of the plant sugars and other substances should provide indication of the interrelationships between the sugars during photosynthesis. The present experiments yield data permitting some deductions concerning such interrelations.

Unstarved sunflower leaves were exposed to $C^{14}O_2$ for 1.5 and 4 min in the light. Leaves starved 43 hr, at which time the respiratory rate was high, were exposed to $C^{14}O_2$ for 16 hr. The leaves were killed and extracted with 80% alcohol. After removal of the alcohol, sucrose, glucose,

fructose, and alanine were isolated from the extract by means of paper chromatography [Science 110, 708(1949)]. In addition, the glucose and fructose of the sucrose were obtained by an invertase hydrolysis, followed by paper chromatography.

The leaf residue was extracted with 10% ethyl alcohol to remove dextrins. The extract was treated with lead acetate, hydrolyzed with acid, and the resulting glucose was isolated by paper chromatography. The solid left after the extraction was treated with saliva, the water-soluble material was hydrolyzed with acid, and the glucose was again isolated by chromatography.

Of the various sugars, only dextrin, starch, and sucrose contained the radioactive carbon. Both the glucose and fructose derived from the sucrose were active. In addition, alanine contained C^{14}.

The distribution of the labeled carbon in the carbon atoms of the several sugars was determined by the method of Wood et al., J. Biol. Chem. 159, 475(1945). The method was also applied to the acetaldehyde and carbon dioxide obtained from alanine by treatment with ninhydrin.

The distributions found are given in the table.

Table 1—Distribution of C^{14} in the Sugars and Alanine; Photosynthesis, 1.5 Min

Carbon Atom No.	Sucrose Glucose	Fructose	Dextrin	Starch	Alanine
3,4	48	48	36	72	47 (COOH)
2,5	25	26	33	14	28 ($CHNH_2$)
1,6	27	25	31	14	25 (CH_3)
		4 min			
	Sucrose				
3,4	37	37	61		41 (COOH)
2,5	33	35	17		29 ($CHNH_2$)
1,6	30	28	22		30 (CH_3)
		Dark Fixation (16 hr)			
3,4	91	74	84		98 (COOH)
2,5	4.5	18	8		0 ($CHNH_2$)
1,6	4.5	8	8		2 (CH_3)

The figures in the table represent the percentage of radiocarbon in the various positions.

The data indicate that in the light, starch approaches uniform distribution of the labeled carbon more slowly than the other substances. Dextrin approaches uniform labeling more rapidly than sucrose, the alanine behaving similarly to the latter. The same condition seems to occur in the dark. The similar distribution of C^{14} in the glucose and fructose of sucrose indicates that these derive from a common precursor; and from the absence of label in the reducing sugars, it is indicated that this precursor is not the same as that giving rise to monosaccharides. It also appears that alanine may derive from the same source as sucrose. It further appears that dextrin must be derived more directly from some primary substance than any of the

other materials. Clearly, further work will be needed before adequate description of the relations between the primary source and the various sugars can be had. However, it may be suggested that each sugar derives from a chain of reactions in which carbon dioxide is being fixed in a series of steps, and from any one step in the chain, each type of sugar is removed. (auth)

3641 Simultaneous Blood Volume Determinations in Dogs with Dye (T-1824), Carbon Monoxide, and Radioactive Iron Fe^{55}. J. L. Nickerson, L. M. Sharpe, W. S. Root, T. C. Fleming, and M. I. Gregersen. AECU-786, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Measurements of the blood volume in dogs were made, using simultaneously the three following technics: (1) the T-1824 dye method as described by Gregersen, (2) the carbon monoxide method according to the technic developed by Roughton and Root, and (3) the radioactive iron (Fe^{55}) method using tagged erythrocytes from a donor dog. Beaker experiments on known volumes (50 cc) of blood were run concurrently with the in vivo tests in order to check the accuracy of the radioactive iron determinations. In 16 beaker experiments the mean volume determined by radioactive iron differed by only 0.5% from the true volume, the standard deviation being 3%.

In seven technically satisfactory experiments the mean value of the blood volume measured by the carbon monoxide method was 2% above the value obtained with T-1824, whereas the mean value obtained with the iron method was 11% below that given by the dye. The latter difference is beyond the limit of experimental error. It is therefore considered to be of physiological significance and not explainable by lack of precision in any of the methods. (auth)

3642 On the Mechanism of Bacterial Fermentation of Glucose to Lactic Acid Studied with C^{14}-Glucose. Martin Gibbs, Rosemary Dumrose, Frances A. Bennett, and Margaret R. Bubeck. AECU-792, nd. 9p.

L. casei (ATCC 7469) did not fix CO_2 during the fermentation of glucose to lactic acid. When 1-C^{14} glucose was fermented to lactic acid, 3% of the label was in the COOH position of the lactic acid. When 3,4-C^{14} glucose was fermented to lactic acid, 3% of the label was in the β position of the lactic acid. The randomization of 3% of the activity might be caused by the formation of a symmetrical 3-carbon intermediate during the bacterial fermentation. The same distribution was obtained when the fermentation was carried out under aerobic or anaerobic conditions and when the time of fermentation was increased from 2 to 24 hr. (auth)

3643 Radioactive Crystalline Ribonuclease. Christian B. Anfinsen. AECU-795, nd. 8p.

Radioactive crystalline ribonuclease has been prepared in vitro by incubation of bovine pancrease slices with $C^{14}O_2$. This protein contains incorporated radioactivity at approximately twice the level of the average slice proteins. Following repeated recrystallization of the radioactive enzyme diluted with nonradioactive carrier, a product was obtained which obeyed phase rule criteria of purity within narrow

limits. The data suggest that the small amount of impurity present is mainly denatured ribonuclease. (auth)

3644 Metabolism of Soy Bean Leaves. I. On the Sequence of Formation of the Soluble Carbohydrates During Photosynthesis. S. Aronoff and L. Vernon. AECU-808, nd. 20p.

By means of radioactive CO_2 it has been shown that under conditions of lengthy photosynthesis (greater than 90 sec) the concentrations of soluble carbohydrates in soy bean leaves (var. Hawkeye) are: sucrose > glucose = mannose > raffinose > fructose; the raffinose, however, is second only to sucrose in activity. The sequence of formation of carbohydrates is: trioses and glucose (trioses probably first), followed by sucrose, then raffinose and mannose. Under all conditions the free hexoses and those obtained from the disaccharides are composed of two equal halves. Because of a nonuniformity of radioactivity within each half of the glucose, that compound must have been derived from two 3-carbon units, probably the trioses. Fructose from hydrolyzed sucrose shows almost uniform distribution at all times, while glucose from the same moeity does not. The formation of sucrose thus appears to follow a different pathway from that of glucose. A rapid method is presented for the determination of the distribution of activity within the hexose molecule and applicable to those polysaccharides which yield hexoses on hydrolysis. 19 references. (auth)

3645 $C^{14}O_2$ Assimilation by Soy Bean Leaves. S. Aronoff and L. Vernon. AECU-818, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

We wish to summarize our findings on the photosynthetic assimilation of $C^{14}O_2$ by excised soy beans leaves during relatively short periods (5 to 90 sec).

Following the assimilation period and the removal of the residual $C^{14}O_2$, the leaves were killed by immersion in liquid nitrogen or CO_2-80% aqueous ethanol. The total time for conclusion of the experiment to leaf killing never exceeded 10 sec. The nature of the products, as shown by chromatography, was not materially changed by the temperature of the extraction with 80% ethanol (0°C, room temperature, reflux temperature).

The primary chromatographic product of carbon dioxide fixation is free glyceric acid. Phosphoglyceric acid increases in relative significance with shorter time intervals, although at the shortest time (5 sec) it is still considerably less radioactive than the nonphosphorylated acid.

The second most prominent product is alanine. Significant, but substantially smaller, amounts of glycine and serine are present, the latter being of higher specific activity than the former. No radioactive aspartic acid was detected within the period of investigation. These results are, except for the degree of phosphorylation, not significantly different from those summarized by Benson and Calvin.

Particular attention has been given to the sequence of carbohydrate formation, with the following conclusions.

(1) The first free sugars formed are the trioses and glucose. It is probable that the trioses precede the glucose if extrapolations of relative specific activities are made to zero time. At the shortest time intervals used in these studies (15 sec) their specific activities were approxi-

mately equal. Subsequent to these sugars are formed sucrose, then raffinose and mannose and possibly fructose. (We are not certain of the extent to which the observed free fructose arises from hydrolysis of sucrose during ion exchange.) In lengthy assimilation (15 min) the sugar present in largest concentration, as well as highest specific activity, is sucrose. Glucose, though in higher concentration than raffinose, is of lower specific activity, while mannose, of a concentration approximately equal to that of glucose, is the least radioactive of the four. Free fructose is present only in very minor quantities. (By contrast, in the roots of these plants the primary sugar is fructose, and the first and main product of phosphorylation is fructose 1,6-diphosphate.)

(2) Under all conditions the free hexoses and those obtained from the disaccharides are composed of two equal halves. Because of the nonuniformity of radioactivity within each half of the glucose, that compound must be derived from two 3-carbon units, probably the trioses.

(3) The glucose portion of the sucrose is formed prior to the fructose. The fructose from the hydrolyzed sucrose shows almost uniform distribution of activity among the six carbons at all times, while glucose from the same moeity does not. Thus the formation of sucrose appears to follow a pathway different from that of glucose.

This sequence of carbohydrate formation is not in agreement with that suggested for Chlorella [Calvin and Benson, Science 109, 140-2(1949)], but there is no reason to believe that an identical pathway is required for all plants.

A full exposition, including experimental details, will be published shortly. (auth)

3646 Manganese Metabolism of Social Vespidae. Vaughan T. Bowen. AECU-825, nd. 43p.

Analyses of the manganese of various stages of the vespid (hornet) life cycle demonstrate accumulation of this element during larval life, extensive loss of the accumulation at pupation, and accumulation again by adults to whom manganese is available. Analyses and radiotracer studies show that accumulation takes place very rapidly in the cells of the mid-gut epithelium. Although males never, and queens only after leaving the nest, built up manganese stores, in contrast to workers who do so almost immediately on pupal emergence, it is concluded that these studies provide no evidence for a nutritional basis for vespid sex development. Workers and larvae are shown to have a regime virtually identical both qualitatively and quantitatively. Radiotracer studies indicate that the distribution of manganese throughout each intestinal cell is not rapid, and transfer to the hemolymph may be discontinuous. The existence of a mineral-holding protein skeleton of high stability, is inferred for the cells of the vespid mid-gut. It is shown that the manganese accumulation of both larval and worker hornets is greatly in excess of any known metabolic usage. It is concluded that the phenomenon has arisen as a response to inefficiency of manganese excretion, coupled with absence of any control of absorption. 48 references. (auth)

3647 Radioautography of Cerebral Tumors Employing P^{32}. Daniel Steinberg and Bertram Selverstone. AECU-829, nd. 10p.

Radioautographs of human brain tumors and of normal brain, employing P^{32}, have been made in 18 cases. A frozen-section technique, without fixation, has been found necessary in order to prevent redistribution of the isotope within the tissues. Autographic blackening has been consistently much higher in tumor tissue than in brain, but is subject to considerable variation within certain tumors. These variations, reflecting differences in uptake of radioactive phosphate ion by various portions of the tumor, may be correlated with certain histologic features in the stained sections. Quantitative microdensitometric measurements have been made, and relative P^{32} uptake has been determined from these data. An attempt is being made to correlate radioautographic features, especially in the gliomas, with histologic appearance and with prognosis. (auth)

3648 Acetic Acid Metabolism in Torulopsis Utilis. I. The Cultivation of Torulopsis Yeast on $C^{13}H_3C^{14}OOH$ as the Single Carbon Source. J. Baddiley, G. Ehrensvärd, R. Johansson, L. Reio, E. Saluste, and R. Stjernholm. J. Biol. Chem. 183, 771-6(1950) Apr.

In a cultivation experiment involving the yeast Torulopsis utilis, acetic acid labeled with C^{13} in the methyl group and C^{14} in the carboxyl group was used as a single carbon substrate for the growth of the yeast. Isotope determinations of the respiratory carbon dioxide liberated during the experiment show a $C^{14}:C^{13}$ ratio of about 2 in comparison to the corresponding ratio of the carbon atoms of acetic acid of the substrate, taken as 1, indicating that for every two carboxyl groups liberated from the acetic acid as CO_2, one methyl group is entering the cycle of metabolic breakdown, finally appearing as respiratory CO_2. The C^{13} content of the yeast substance formed was relatively higher than the corresponding C^{14} content, the latter appearing mainly in the carboxyls of the amino acids formed, but also to some extent in the noncarboxylic parts of some neutral and basic amino acids. (auth)

3649 Acetic Acid Metabolism in Torulopsis Utilis. II. Metabolic Connection Between Acetic and Tyrosine and a Method of Degradation of the Phenolic Ring Structure in Tyrosine. J. Baddiley, G. Ehrensvärd, E. Klein, L. Reio, and E. Saluste. J. Biol. Chem. 183, 777-88(1950) Apr.

A method has been developed which enables the following carbon atoms of tyrosine to be isolated in the form of carbon dioxide: the carboxyl, β, 3 and 5, 1 and 3, 5 and 2, 4 and 6, and, finally, 1 and 4. Tyrosine obtained from a protein hydrolysate from Torulopsis yeast, grown on labeled acetic acid (C^{14} and C^{12}) as a single carbon source, was degraded by this method, and the isotope content of each carbon atom of the tyrosine was determined. The carboxyl group of the administered acetic acid appeared as the carboxyl and the ring atom 4 of tyrosine, while the methyl group contributed mainly to the α, β, 1, 2, and 6 atoms; the origin of atoms 3 and 5 is uncertain. The mechanism of tyrosine synthesis is discussed. (auth)

3650 Antigen Tracer Studies and Histologic Observations in Anaphylactic Shock in the Guinea Pig. Part Two. Frank J. Dixon and Shields Warren. Am. J. Med. Sci. 219, 414-21(1950) Apr.

BIOLOGY AND MEDICINE

The present study was undertaken to determine whether I^{131}-labeled egg albumin antigen was concentrated in the bronchi of male guinea pigs during shock because of a specific affinity of the sensitized tissues for the shocking antigen or because of a nonspecific accumulation of protein in the process of edema formation. A total of 40 mc of I^{131} was used to label each 100 mg of albumin; sensitizing injections consisted of 25 mg of protein given intraperitoneally; all shock injections were made into the femoral vein, the albumin being administered in 5-mg doses as a 10% aqueous solution. Eleven of the animals were used as nonsensitized controls, were given intravenous injections of the albumin, and were killed shortly thereafter; 10 animals were sensitized with nonradioactive iodinated albumin and were given the shock dose after two weeks; the remaining 8 animals were sensitized to bovine fibrinogen and were given the shock dose two weeks later. It was found that the edema formation and the concentration of antigen in the bronchial tissue during the anaphylactic shock produced by the albumin was similar to that seen when γ globulin was used. This antigen localization seems to be a binding of specific antigen at the site of one of the sensitivity reactions, the bronchial wall. The bronchial stenosis, present at time of death in albumin-induced anaphylactic shock, is caused primarily by smooth-muscle contraction present about some of the bronchi and to a lesser degree by moderate edema formation in the collagenous connective tissue about most of the bronchi. Egg albumin is rapidly lost from the blood stream; part of this loss is caused by renal excretion.

3651 The Behavior of Radioiodine in the Blood. William M. McConahey, F. Raymond Keating, Jr., and Marschelle H. Power. J. Clin. Invest. 28, 191-8 (1949) Mar.

A study is reported of the behavior of I^{131} in blood after its oral administration, the comparison of the disappearance rates of I^{131} from the blood as determined directly and by urine sampling methods, and the appearance in the blood of organically bound I^{131} on 31 humans with various thyroid conditions. The patients received 150 cc of an aqueous solution of 100 μg of sodium iodide containing 100 μc of I^{131}. The method and controls are completely described, and a breakdown of the type of dose (therapeutic or tracer) and thyroid conditions of the subjects are given. Time graphs up to 150 hr after injection are given for I^{131} % of dose per liter of serum, and a table of urine excretion is also included in the report. The results are extensively discussed, with special considerations of the inadequacy of the method used for making quantitative conclusions. The authors believe that the data indicate that the rate of disappearance of radioiodine from the blood reflects variations in thyroidal function, and the two methods of determining the rate of disappearance of radioiodine from blood do not give significantly different results. 15 references.

3652 Biochemical Application of Tracers. Wiktor W. Nowinski. Texas J. Sci. 1, 102-6(1949).

The importance of tracers in biochemical research is illustrated on a series of examples. (auth)

3653 Biotin in the Assimilation of Heavy Carbon in Oxalacetate. G. E. Wessman and C. H. Werkman. Arch. Biochem. 26, 214-18(1950) Apr.

BIOLOGY AND MEDICINE

In exchange reactions involving oxalacetate and $NaHC^{13}O_3$, it was found that fixation of carbon dioxide in oxalacetate is prevented when avidin is added to inactivate the biotin; the addition of adequate biotin results in a return to normal fixation. The authors state that the evidence appears conclusive that biotin functions as a coenzyme in the fixation of carbon dioxide. 12 references. (auth)

3654 Comparative Studies on Nitrogen Excretion. A. G. C. White and W. Parson. Arch. Biochem. 26, 205-8(1950) Apr.

The comparative excretion rates of yeast nitrogen and glycine nitrogen were investigated in three normal adult male rats with the aid of N^{15}. The rats were first fed on a protein diet, then either of the two labeled compounds was then substituted, and urine samples were collected for 3 days. It was found that yeast nitrogen was excreted more slowly than that of glycine; this is partly explained by the slower absorption rate of yeast nitrogen due to the necessity of prior digestion. Further work is concluded to be necessary to substantiate and explain the observed differences in nitrogen excretion.

3655 A Comparative Study of Red Cell Volumes in Human Subjects with Radioactive Phosphorus Tagged Red Cells and T-1824 Dye. Herman M. Nachman, G. Watson James III, John W. Moore, and Everett Idris Evans. J. Clin. Invest. 29, 258-64(1950) Feb.

The importance of the total blood volume and the red cell volume in the hemodynamics of shock, burns, hemorrhage, and fluid replacement is discussed. Forty experiments were run on a random sample of surgical cases, using two volume-measurement methods, T-1824 dye and P^{32}-tagged red cells. Details of the methods, calculations, and results are given and discussed. The discrepancy between the two methods is explained and compared statistically with determinations done with radioiron, and the advantages of the P^{32} tag above the iron tag are discussed. 26 references.

3656 The Conversion of Acetate to Glycine in the Rat. H. R. V. Arnstein and A. Neuberger. Biochem. J. 45, iii-iv(1949).

Adult rats were administered sodium acetate labeled with C^{14} on the methyl and carboxyl groups and were also given at the same time DL-α-amino-γ-phenylbutyric acid and sodium benzoate. Hippuric acid and L-α-acetamido-γ-phenylbutyric acid were isolated from the urine, and their radioactivity was determined. The activities of the hippuric acid show that both carbon atoms of acetate appear in the glycine molecule, though the specific activity of the hippuric acid is very much smaller than that of the acetamido compound. Other results are included. It is suggested that the synthesis from acetate represents a major pathway for the synthesis of glycine from nitrogen-free precursors.

3657 Experiments with Radiophosphorus on the Uptake of Phosphorus by Wheat. H. G. Dion, J. W. T. Spinks, and J. Mitchell. Sci. Agr. (Ottawa) 29, 167-72(1949).

In greenhouse experiments using tracer phosphorus, P^{32}, it was showed that a significantly greater uptake of P^{32} by wheat plants was obtained from mono-ammonium phosphate than from either monocalcium or tricalcium phosphates;

BIOLOGY AND MEDICINE

the experiments were carried out on a chesnut silt loam soil of neutral reaction. While yield responses indicated that applying the phosphate with the seed was better than at 2 or 4 weeks after seeding, the uptake of P^{32} appeared to be higher in the after-seeding applications.

3658 Further Studies on the Metabolism In Vitro of Radioactive Trilaurin and Sodium Octanoate. R. P. Geyer, L. W. Matthews, and F. J. Stare. J. Biol. Chem. 182, 101-8(1950) Jan. (See also NSA 3-2061 and 4-957.)

The effects of such supplementary substrates as fumarate, malate, oxalacetate, α-ketoglutarate, and pyruvate, and the inhibitors malonate, NaN_3, NaF, iodoacetic acid, β-iodopropionic acid, maleic acid, and 2,4-dinitrophenol on the metabolism of trilaurin ($-C^{14}OO-$) with an activity of 920 counts/mg/min and sodium octanoate ($-C^{14}OO$) with an activity of 6,500 counts/min/mg) in rat-liver and kidney-tissue preparations were studied, with especial emphasis on malonate inhibition. Details of the procedure are outlined; the total and specific activity of CO_2 is tabulated, and some results are graphed. The results are thoroughly discussed, and a possible mechanism for inhibition and supplementation in the tricarboxylic acid cycle is suggested. 6 references.

3659 The Irreversibility of the Deamination of Threonine in the Rabbit and Rat. D. F. Elliot and A. Neuberger. Biochem. J. 46, 207-10(1950) Feb.

Glycine containing excess N^{15} was fed to rabbits and rats, and various amino acids were isolated from the protein of muscle and internal organs. The glycine, serine, glutamic acid, arginine, and tyrosine contained varying concentrations of isotopic nitrogen; lysine and threonine had no excess N^{15}. It is concluded that threonine, like lysine, does not take part in the reversible transfer of nitrogen which is observed with other amino acids, both "essential" and "nonessential". The glycine and serine isolated contained similar proportions of N^{15}. This is taken to indicate that the conversion of glycine to serine is very fast compared with other reversible reactions in which the two amino acids participate. 28 references. (auth)

3660 Limnological Studies in Connecticut. IX. A Quantitative Radiochemical Study of the Phosphorus Cycle in Linsley Pond. G. Evelyn Hutchinson and Vaughan T. Bowen. Ecology 31, 194-203(1950) Apr.

The phosphorus cycle in lakes was studied by the addition of P^{32} to the surface of the lake. By estimating total activities, it was shown that phosphorus is sedimented from the epilimnion into the hypolimnion, but that such phosphorus as reaches the sediments is rapidly regenerated, passing again into the free water. Phosphorus passes into the littoral vegetation and from such vegetation into the free water again. A mobile fraction of high activity in the littoral zone is attributed to the presence of short-lived organisms there. Almost the entire increase in activity in the hypolimnion occurred during the first week. It is believed that immediately on addition practically all the radiophosphorus enters the phytoplankton which can easily be sedimented. Evidence exists for movements of phosphorus into the hypolimnion from the mud also, but this does not occur above 5.3 m. The observed rate of entry of phosphorus into the epilimnion corresponds to replacement every 3 weeks.

BIOLOGY AND MEDICINE

3661 The Mechanism of the Action of Notatin. R. Bentley and A. Neuberger. Biochem. J. 45, 584-90(1949).

In order to determine the mechanism of action of notatin, glucose oxidation by notatin was carried out in water enriched with O^{18}; the hydrogen peroxide produced was subsequently decomposed with catalyase, and the ratio of isotopic O^{18} present was determined. It was shown that the oxygen atoms of the hydrogen peroxide were derived from molecular oxygen. It is concluded that notatin catalyzes the transfer of hydrogen from glucose to oxygen; the first product of the enzymatic reaction is concluded to be a neutral substance, δ-gluconolactone, which changes into gluconic acid. The mechanism of transfer of two hydrogen atoms of glucose to oxygen is discussed.

3662 Meeting of the Agriculture Group of the Society of Chemical Industry, Held at London on Feb. 21, 1950. Chemistry & Industry, No. 14, 270(1950) Apr. 8.

Among the papers presented were two on "The Use of Isotopes in Agricultural Research" by P. A. Collier and A. L. Low. In the first paper, Mr. Collier discussed the different applications of stable and radioactive isotopes, the means of detection and assay of radioactive preparations, and certain precautions necessary for safe experimentation with radioactive compounds; the radioautographic technique was outlined; plant studies were referred to. Mr. Low emphasized, in the second paper, the possibility of tracing the path of fertilizer element absorption by plants with radioisotopic techniques. Certain difficulties were pointed out, such as plant inability to distinguish between P^{31} and P^{32}, and the possibility of harmful radiation effects on plants, due to the absorbed radioactivity. Other researches and experiments involving the use of Ca^{45} and N^{15} were described by Mr. Low.

3663 Physiological Reactions of the Thyroid-Stimulating Hormone. Rulon W. Rawson. Ann. New York Acad. Sci. 50, 491-507(1949).

The thyroid of cockerels treated with thyroid-stimulating hormone (TSH) showed a loss of thyroid iodine, an increase in thyroid-acinar-cell heights, an increase in weight of the thyroid gland, and an increased capacity to concentrate radioactive iodine. Iodine inhibited the inactivation of TSH by slices of thyroid tissue. Both iodine and thyrosine also inhibited the action of TSH on the thyroid of hypophysectomized rats.

3664 Plasma Volume and Extravascular Fluid Volume During Pregnancy and the Puerperium. William L. Caton, Charles C. Roby, Duncan E. Reid, and John G. Gibson, 2d. Am. J. Obstet. Gynecol. 57, 471-81 (1949) Mar.

In order to investigate the changes occurring during normal pregnancy in the circulating red cell mass and the plasma and extracellular fluid volumes, simultaneous determinations of plasma and extravascular fluid volume were done on 10 patients at 5- to 6-week intervals during pregnancy and at the end of the first postpartum week. While under fasting basal conditions in all tests the patients received 10-mg injections of T-1824 and 100 cc of whole fresh blood labeled with radioiron, after which heparinized samples were taken at 10-min intervals for 50 min. The method is described and the results are tabulated, graphed, and discussed.

BIOLOGY AND MEDICINE

3665 Radioactive Isotopes. Sister Mary Antonia. Am. J. Med. Technol. 15, 207-13(1949) July.

This is a brief review of the method of radioactive isotope production and the use of tagged molecules in biology with special reference to medical technology.

3666 Radioactive Phosphorus (P^{32}) Used to Study Phosphate Exchange Between Urine in the Renal Pelvis and Renal Calculi Containing Phosphate. John A. Benjamin, William F. Neuman, Herbert E. Thompson, and Christine Waterhouse. Science 111, 498-9(1950) May 5.

Two females, one a test patient with unilateral renal calculi and the other a normal control patient with no urinary tract calculi, were given P^{32} orally as acid sodium phosphate (70 and 130 μc, respectively). Urine specimens from both patients were then collected directly from the renal pelves at various time intervals over a total of 700 min. Twenty-four hours after the P^{32} dosage, 16 renal calculi weighing a total of 0.850 g were removed surgically from the test patient, two of which were analyzed chemically and five for radioactivity; the urine was also measured for radioactivity. Shortly after the P^{32} administration the specific activities of urine specimens from the kidney containing the stones rose more slowly than those of the control kidney and remained elevated at later time intervals; both kidneys of the control patient excreted phosphate of the same specific activity. The author suggests that ionic exchange takes place between the phosphorus of the calculi and the P^{32} and accounts for the lower but more sustained output of radioactivity in the urine of the test patient. Further studies are in progress.

3667 The Relationship of Serine to Porphyrin Synthesis. David Shemin, Irving M. London, and D. Rittenberg. J. Biol. Chem. 183, 767-9(1950) Apr.

Glycine, acetylglycine, and DL-serine labeled with N^{15} were administered to rats in separate feeding experiments, and the N^{15} concentration of the heme was determined in each instance. Additional experiments consisted in incubating duck blood with isotopic glycine, DL-serine, NH_4Cl, L-aspartic acid, DL-alanine, or acetylglycine and similarly determining the N^{15}-heme concentration. It was found that serine is utilized for the synthesis of heme by virtue of its conversion to glycine; acetylglycine, as such, is not utilized.

3668 The Site of Action of Penicillin. I. Uptake of Penicillin on Bacteria. D. Rowley, P. D. Cooper, P. W. Roberts, and E. Lester Smith. Biochem. J. 46, 157-61(1950) Feb.

The preparation of radioactive penicillin containing S^{35} is described; the amount of penicillin which becomes attached to bacteria under various conditions was measured, and the uptake most probably responsible for its antibacterial activity was found. This uptake appears to be due to a direct chemical reaction with a cellular component present in minute amounts in resting bacteria, more of which becomes available to the penicillin during growth. 10 references. (auth)

3669 The Solitary Thyroid Nodule and Thyrotoxicosis. H. L. M. Roualle. Brit. J. Surg. 36, 312-14(1949) Jan.

BIOLOGY AND MEDICINE

After an analysis of 207 thyroid operations, including four cases presented in detail, the author discusses nodular formation and thyrotoxicosis with special reference to iodine metabolism. A brief review is presented of thyroid studies involving the use of I^{131} and its affinity for hyperactive thyroid tissue.

3670 Studies in Methionine Metabolism. III. The Fate of Intravenously Administered S^{35}-Labeled Methionine in Normal Adult Males, in Patients with Chronic Hepatic Disease, "Idiopathic" Hypoproteinemia and Cushing's Syndrome. Laurance W. Kinsell, Sheldon Margen, Harold Tarver, Julie McB. Frantz, Erin K. Flanagan, Maxine E. Hutchin, George D. Michaels, and David P. McCallie. J. Clin. Invest. 29, 238-50 (1950) Feb.

Methionine-S^{35} was administered to 3 normal patients and 5 others with chronic liver damage, hypoproteinemia, and Cushing's syndrome in this study. The details of the procedure are given, including graphs on the metabolism of methionine, the disappearance of S^{35} from plasma protein, urinary excretion of S^{35}-labeled organic sulfur and S^{35}-labeled total sulfate, the S^{35} plasma content (excluding protein), the S^{35} stool content, and the incorporation of S^{35} into plasma protein in all patients over a period of hours and days. The results are discussed in terms of their clinical possibilities. The authors conclude that S^{35} is safe for research on humans, that the methione-S^{35} incorporation rate into plasma protein is predictable as well as the disappearance and excretion rates in normal individuals, and that protein anabolism is not impaired in Cushing's syndrome, but is impaired in liver disease; hypoproteinemia cases demonstrate an excessive rate of plasma protein catabolism. 13 references. (auth)

3671 Studies on the Effects of Concomitant Venous Ligation in Acute Arterial Occlusion. M. L. Cullen, L. G. Steppacher, Benjamin Greenspan, H. E. Milliken, Jr., G. W. Moore, and G. C. Morris, Jr. Surg. Gynecol. Obstet. 89, 722-6(1949) Dec.

In order to find a more sensitive test for the determination of circulatory changes following ligations of major vessels, rabbits under nembutal anaesthesia were treated with radiosodium by the method of Brook, Johnson, and Kirtley, and other methods. The techniques are completely described, and results are graphed and tabulated. Doses of 100 to 200 μc of radiosodium were administered intravenously to the dogs, and readings of a counter were taken continously in the paw for 1 hr; 5.0 to 10.0 μc of radiosodium was administered to the rabbits, and counter readings were taken over 15-min periods. The authors conclude that: concomitant venous ligation is of little benefit in acute arterial occlusion; that further studies using radiosodium intradermally may give more information on the problem since technical difficulties made its use impractical in the experiments reported; that studies on muscular circulation involving the use of radiosodium in intramuscular injections fail to show any improvement resulting from the venous ligation in acute arterial occlusion.

3672 A Study of the Rate of Oxidation of the Methyl Group of Dietary Methionine. Cosmo G. Mackenzie, Julian R. Rachele, Nancy Cross, Joseph P. Chandler, and

BIOLOGY AND MEDICINE

Vincent du Vigneaud. J. Biol. Chem. 183, 617-26 (1950) Apr. (See also NSA 4-624.)

The rate of oxidation of the methyl group of dietary methionine has been measured in rats (fed diets containing choline and cystine, and either 0.6 or 1.2% methionine) by determining the amount of radiocarbon dioxide expired following the ingestion of a single meal in which C^{14}-labeled methionine replaced the ordinary methionine otherwise present in the diet. On both diets the oxidation of the radiomethyl group fell into two phases: during the first phase, or period of assimilation, there was a rapid rise in the rate of oxidation to a maximum attained during the 3d hr, followed by a decline until the 7th or 8th hr; the second phase, or period of equilibrium, was initiated at this time by the establishment of a low and relatively constant rate of oxidation. Doubling the methionine content of the diet produced a ninefold increase in the per cent of radiomethyl groups oxidized during the period of assimilation; it had relatively little effect on the rate of oxidation during the period of equilibrium, or on the % of radiomethyl carbon excreted in the urine or feces in 24 hr. (auth)

3673 Synthesis of Heme In Vitro by the Immature Non-Nucleated Mammalian Erythrocyte. Irving M. London, David Shemin, and D. Rittenberg. J. Biol. Chem. 183, 749-55(1950) Apr.

The capacity for heme synthesis in blood samples from rabbits was investigated with the aid of isotopic nitrogen, N^{15}. In a typical experiment, 20 to 30 ml of blood withdrawn from a rabbit was added to a flask containing heparin, 50 mg of glycine labeled with 32 at. % excess N^{15}, and 1 to 2 mg each of crystalline penicillin and streptomycin (to inhibit bacterial formation). The flasks were incubated for 24 hr, and the blood was aerated with a 95% O_2-5% CO_2 mixture; at the end of incubation the blood was centrifuged and the serum removed; hemin was prepared from the red cells, in which reticulocytosis had been previously produced by the administration of acetylphenylhydrazine recrystallized, and analyzed. From the results of the experiments it was determined that the immature nonnucleated rabbit erythrocyte is capable of synthesizing heme in vitro.

3674 The Synthesis of Protoporphyrin in Vitro by Red Blood Cells of the Duck. David Shemin, Irving M. London, and D. Rittenberg. J. Biol. Chem. 183, 757-65(1950) Apr.

The use of red blood cells of the duck as a system for the study of the biosynthesis of the porphyrin, heme, is described. Adult ducks were exsanguinated, the blood was collected, heparinized, and filtered, and penicillin and streptomycin were added. The compounds to be tested were added to 20-ml samples of the blood in individual experiments, and heme synthesis was compared with that observed in control samples. Glycine labeled with N^{15} was added as a factor conditioning heme production in vitro; the incubation time and temperature were other factors tested, as well as the influence of oxygen tension, progressive washing of the blood, storage of the blood, and effects of cyanide. It was found that there was synthesis of heme from glycine in vitro; the synthesis of peptide bonds was also demonstrated. The conditions under which heme may be synthesized in vitro are described. 13 references.

BIOLOGY AND MEDICINE

3675 Third Inter-American Cardiological Congress. Am. Heart J. 37, 620-88(1949) Apr. 1.

Among the papers presented were: Observations on Blood Volume as Determined by Plasma Dye Dilution and Dilution of Red Cells Tagged with Radioactive Phosphorus, H. S. Mayerson, Robert T. Niesset, and Champ Lyons; Further Studies of the Circulation with Radioactive Erythrocytes, Gustav Nylin and S. Hedlung; Biosynthesis of Radioactive Digitoxin Using Carbon 14, E. M. K. Geiling, F. E. Kelsey, and B. J. McIntosh. The first paper is a report of independent studies in patients on the rate of absorption and loss of radioactive phosphorus from the plasma in vivo in order to check the validity of red cell volume determinations by a simple dilution method, using the radioactive phosphorus as a tracer.

3676 Tracer Studies of the Urinary Excretion of Radioactive Mercury following Oral Administration of a Mercurial Diuretic. William J. Overman, William H. Gordon, and G. E. Burch. Circulation 1, 496-501(1950) Apr.

By means of tracer methods the absorption, blood concentration, and urinary excretion of mercury following oral administration of standardized single doses of plain and enteric-coated capsules of a mercurial diuretic were studied in 22 control subjects and in 5 subjects with chronic congestive heart failure; "Mercuhydrin" labeled with $Hg^{203,206}$ was used. Enteric coating of the capsules resulted in the lowest blood concentrations and in the poorest urinary excretion of mercury, which indicates that maximum absorption occurred high in the gastrointestinal tract. Even with more efficient plain gelatin capsules the blood concentration was low compared with intravenous administration, and the amount excreted in the urine averaged only 5.0% of the amount administered orally. The addition of ascorbic acid had no significant influence on urinary excretion. In no instance did oral administration of the diuretic result in a urinary excretion of mercury equivalent in amount to that following a therapeutic parenteral dose, even though the drug was administered orally in toxic doses to several subjects. It is calculated that the poor absorption, low blood concentration, and low urinary excretion of mercury following oral administration of the mercurial diuretic precludes its general use in the treatment of chronic congestive heart failure. 16 references. (auth)

3677 The Uptake of Radioactive Phosphorus from Host Tissues and Fluids by Nematode Parasites. W. P. Rogers and Marian Lazarus. Parasitology 39, 245-50(1949).

Animals infected with nematode parasites were given a solution of Na_2HPO_4 containing about 2 μc of P^{32}; the animals were then killed at intervals, and the parasites were collected, washed, ashed, and measured for radioactivity. It was found that Ascaris lumbricoides had a high concentration of the isotope in the intestine, uterus, and blood serum; Nippostrongylus miris took up the P^{32} when admisistered intramuscularly, but not when given orally; Ascaridia galli failed to take up P^{32} when administered intravenously to the host birds. It is concluded that the nematode parasites have a high demand for phosphate and that their different feeding habits appear to have some relation to the efficacy of the various antihelmintics used against these parasites.

BIOLOGY AND MEDICINE

3678 The Use of Tracers in the Field of Medicine. Allen F. Reid. Texas J. Sci. 1, 109-12(1949).

A review of the use of the common radioactive elements in their applications to biochemical, biophysical, and medical problems is given. Distribution tracers, exemplified by radiophosphorus and radiosodium in the circulatory system, and function tracers, exemplified by thyroid-concentrated iodine and specific lesion-concentrated radioactive dyes, are described. Other applications, including radioautography and cell-life measurements, are treated. (auth)

CHEMISTRY

3679 Electrometric Titrations of Zirconium and Hafnium Solutions. Edwin M. Larsen and Adrian M. Gammill. University of Wisconsin, Jan. 31, 1950. 14p. (AEC File No. NP-1398.)

Previous quantitative investigations of the changes in pH during the addition of bases to solutions of zirconium salts appear to be limited to single studies of zirconium in chloride and sulfate solutions. An investigation of the solutions of these elements with the more common anions in order to establish differences in the behavior of these two elements has been made and results obtained as follows: The pH of precipitation of hafnium hydroxide is always higher than for zirconium hydroxide for the perchlorate, nitrate, and chloride solutions at equivalent concentrations. The difference in the pH of precipitation for zirconium and hafnium from perchlorate solutions is very small, but the difference is quite marked in the nitrate and chloride solutions. The zirconium precipitates at progressively lower ratios of hydroxyl ion added to the metal ion concentration as the metal ion concentration is reduced, whereas the hafnium precipitates at nearly constant ratios. Increased anion concentration increases the pH of precipitation in all cases. For the sulfate solutions, the hafnium precipitates at lower pH's than the zirconium. The precipitates were probably basic sulfates. For the perchlorate solutions, over three-fourths of the precipitation range, the logarithm of the hydroxyl ion concentration is a linear function of the metal-ion concentration. From the slope of -0.6, the average formula of the ion in solution is shown to be $[M(OH)_{3.4}^{+0.6}]_n$. Solubility products for zirconium and hafnium hydroxides are calculated. 15 references.

3680 The Colorimetric Determination of Trace Amounts of Chromium in Tissue. Avard M. Mitchell and Seymour J. Gray. AECU-779, nd. 14p.

Chromium in amounts of 3 to 5 μg in 10 g of tissue may be determined with a 6% error. The tissue is subjected to acid digestion, and the chromium is separated from diverse ions, including iron, by virtue of its different solubility properties in the trivalent and hexavalent states. The quantitative determination of chromium is based upon the photometric measurement of the red color resulting from its reaction with diphenylcarbazide. Iron and other diverse ions do not interfere with the determination. Spectrographic analyses reveal that the method of separation is effective. (auth)

3681 Analytical Methods for Fission Products; Tin and Antimony. G. B. Cook. AERE-C/R-424, Sept. 1949. 7p.

CHEMISTRY

Two methods for the estimation of tin activities in fission-product mixtures are discussed, and one of them is used to determine the fission yields of 28-hr $Sn^{(121)}$ and 10-day $Sn^{(123)}$. Values of 1.10×10^{-2} and 1.25×10^{-2} were obtained for the former, and 1.19×10^{-2} and 1.16×10^{-2} % were obtained for the latter. The values for $Sn^{(123)}$ are considerably higher than the previous figure. For the estimation of antimony the electrolytic formation of stibine is recommended, which readily gives chemical yields of greater than 60%. 17 references. (auth)

3682 Determination of Radiophosphorus in Plant Material by Solution Counting. Clayton McAuliffe. Anal. Chem. 21, 1059-61(1949).

A rapid method for P^{32} determination in solution, accurate to 1%, uses a Geiger-Muller counter assembly and a U standard. Factors influencing the count, such as solution volume, K^{40} background, temperature, self-absorption, and isotope adsorption on glass, are discussed. The samples are ashed and oxidized with 8N nitric acid, the silica is rehydrated with HCl, the residue is taken up in 2N nitric acid, silica is centrifuged down, and P^{32} is counted.

3683 The Estimation of Radioactive Strontium, Barium, Cobalt and Iodine in River Water. J. F. Duncan, T. F. Johns, K. D. B. Johnson, H. A. C. McKay, W. R. E. Maton, E. W. A. Pike, and G. N. Walton. J. Soc. Chem. Ind. 69, 25-9(1950) Jan.

Methods have been developed for the estimation of radioactive strontium, barium, cobalt, and iodine in river water down to 10^{-10} to 10^{-11} c/liter. The methods involve chemical separations for each element in turn, followed by β-ray counting under sufficiently sensitive conditions. The recommended chemical separations are briefly as follows: (1) For combined strontium and barium, the water sample is evaporated to a small bulk with the addition of sodium carbonate solution. The precipitated carbonates are treated with 80% nitric acid, which dissolves everything but strontium and barium nitrates and a mainly siliceous residue. The mixed nitrates are dissolved in water, and the carbonates are precipitated for counting. (2) For strontium and barium separately the usual chromate method is employed. (3) For cobalt the water sample is evaporated down with nitric acid. Ammonium cobaltothiocyanate is extracted with a mixed amyl alcohol–ether solvent. The cobalt is precipitated as ferrocyanide for counting. (4) For iodine the iodine is extracted from the water sample by means of carbon tetrachloride and precipitated as silver iodide for counting. (auth)

3684 Influence of Self-Absorption, Volatilization, and Deliquescence in Counting of Radioelements. Frank J. Kelly, C. Thorpe Ray, S. A. Threefoot, and G. E. Burch. J. Lab. Clin. Med. 35, 606-21 (1950) Apr.

A study of the behavior of $Hg^{203,205}$, Cl^{38}, Na^{22}, Na^{24}, K^{42}, P^{32}, and I^{131} in water, human urine, and human plasma, in vitro and in vivo, indicated that self-absorption, volatilization, and deliquescence offer special problems in radiobiology. Although these factors behave exactly as would be expected, they may be overlooked because of some of the peculiar experimental conditions encountered in biologic investigations.

CHEMISTRY

A correlation of gravimetric and radiometric determinations of preparations of the previously mentioned isotopes in water, urine, and plasma on filter-paper disks after drying them at various temperatures revealed that to control these factors, careful attention should be paid to the chemical environment and, more important, the method and temperature of drying the biologic materials for counting. (auth)

3685 Inorganic Chromatography on Cellulose. II. The Separation and Detection of Metals and Acid Radicals on Strips of Absorbent Paper. F. H. Burstall, G. R. Davies, R. P. Linstead, and R. A. Wells. Chemical Research Laboratory (Teddington) Report No. CRL-AE-40, Oct. 1949. 28p.

A method for the separation and detection of a number of metallic ions and acid radicals by extraction with organic solvent mixtures on strips or sheets of absorbent paper is described. Detection is accomplished by spraying the strip or sheet of paper with a solution containing suitable reagents; the presence of individual metals or acid radicals is then made visible by characteristic colored bands. The groups of ions that have been separated are tabulated. The ratio of the distances moved by the ion to that moved by the solvent (R_F value) has been determined in a number of cases. The significance of these measurements is discussed. 13 references.

3686 A Method of Preparing Biologic Fluids for Counting of Radioelements. George Burch, Paul Reaser, Thorpe Ray, and Sam Threefoot. J. Lab. Clin. Med. 35, 626-30(1950) Apr.

A method is described for the preparation of samples of biological fluids containing radioelements, which is claimed to be simple, accurate, inexpensive, and dependable in many experiments. A small known quantity of the biological fluid is dropped from a micropipet onto a filter paper, at different points to ensure spreading; the filter paper is placed in the center of a tin-coated metal disk having a low lip; the preparation is then dried, then the paper disk is cemented firmly to the metal disk and assayed for radioactivity with a counter. Errors due to self-absorption, poor geometric relationship, deliquescence, and other factors were less when filter-paper disks were employed than when samples of biological fluid were placed on plastic sheets or in metal, glass, or plastic containers.

3687 A Micropipette for Preparation of Samples for Counting in Radiobiology. George Burch, Paul Reaser, Sam Threefoot, and Thorpe Ray. J. Lab. Clin. Med. 35, 631-3(1950) Apr.

A pipet for the delivery of quantities of fluids containing radioelements, during the preparation of samples for counting has been devised and is described; it has proved to be simple, sturdy, and dependable for the authors. The pipet has been standardized by gravimetric and radiometric procedures and has been found to have a mean error of 0.48% with a standard deviation of ±0.34%, the maximum error encountered being 2.8%. It is concluded that for the usual type of radiobiologic experimental purposes the pipet is sufficiently accurate for good work.

CHEMISTRY

3688 Thermogravimetric Analysis of Precipitates. Part 33. Determination of Titanium. Thérèse Dupuis and Clément Duval. Analyt. Chim. Acta 4, 180-5 (1950)(in French).

The effect of heat on the precipitates serving for the gravimetric determination of titanium was investigated with the aid of the Chevenard thermobalance. The precipitation by ammonia, as described by Trombe (Compt. rend. 215, 539(1942); ibid. 225, 1156(1947)), is studied, and three other methods for the automatic determination of titanium are proposed, viz., the precipitation of titanium iodate and dichloro- and dibromo-5.7. oxinates. (auth)

3689 Thermogravimetric Analysis of Precipitates. Part 34. Determination of Germanium. Thérèse Dupuis and Clément Duval. Analyt. Chim. Acta 4, 186-9(1950)(in French).

A study was made of various precipitates that have been proposed for the gravimetric determination of germanium. The best results are obtained with germanium sulfide, tannate, and oxinate, the last named permitting an automatic determination (plateau from 50 to 115°). (auth)

3690 Report of the Committee on Atomic Weights of the American Chemical Society. Edward Wichers. J. Am. Chem. Soc. 72, 1431-2(1950) Apr.

The Commission on Atomic Weights of the International Union of Chemistry, at its meeting at Amsterdam in September 1949, revised the value of the atomic weight of beryllium from 9.02 to 9.013. The following nomenclature was adopted:

Atomic number	Name	Symbol
43	Technetium	Tc
61	Promethium	Pm
85	Astatine	At
87	Francium	Fr
93	Neptunium	Np
94	Plutonium	Pu
95	Americium	Am
96	Curium	Cm

It was recommended that the name of the element, known in the United States as tungsten, be changed to wolfram and that the designation columbium be changed to niobium. A table of "International Atomic Weights" as of 1949 is given.

3691 Oriented Overgrowth of Alkali Halides on Ag, Bi, Sb, and Fe. Gerald W. Johnson. AECU-766, Dec. 5, 1949. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Royer (Bull. soc. franç. minéral. 51, 7(1928)) gave as one condition for the occurrence of oriented overgrowth that the substances have the same type of binding. While the orientation of evaporated metallic films by cleaved ionic crystals is well known, there have been few reports of epitaxy of ionic crystals crystallized from solution on metals. Recently several cases of this type of epitaxy have been found here. Sodium chloride was completely oriented on silver films having (1 0 0) and (1 1 1) planes exposed.

CHEMISTRY

NaCl, KCl, and RbCl all were oriented on the (1 1 1) plane of Bi, while only NaCl was oriented by the (1 1 1) of Sb. On polycrystalline Ag, Bi, and Sb, sodium chloride crystals were oriented by almost every grain. On polycrystalline Fe, only CsCl was oriented and only for particular orientations of the Fe grains. From the number of cases of epitaxy here for polycrystalline aggregates, clearly closeness of fit of lattice cannot be a strict criterion for oriented growth. The requirement that the type of binding of the two structures be the same must be relaxed. On polycrystalline substrates, growth across boundaries often occurred without modification which suggested that the orientations are determined in the nucleation stage. (auth)

3692 Interaction Between Paramagnetic Ions in Crystals. Norman Elliott. AECU-771, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The magnetic susceptibilities of manganous fluoride and solid solutions of manganous and zinc fluorides obey the Weiss-Curie law over a wide temperature range. The paramagnetic Curie temperature is found to be linearly dependent on the manganous ion concentration. The results will be discussed in relation to the Heisenberg exchange interaction. (auth)

3693 Oriented Overgrowth of Alkali Halides on Metals. G. W. Johnson. AECU-796, Jan. 27, 1950. 6p.

Several cases of epitaxy of alkali halides crystallized from solution on metallic surfaces showed that oriented overgrowth occurs even when the lattice fit is not particularly close. The fact that only NaCl was oriented by Sb indicated that lattice spacings must be considered. On most polycrystalline materials, some form of epitaxy occurred on almost every grain. By studying the density of crystallization from grain to grain of NaCl on polycrystalline silver, the grain struction could be determined. In general, there was no preference for grain boundaries as sites for nucleation of crystallization.

3694 Photochemistry of Rutile. W. A. Weyl and Tormod Förland. Ind. Eng. Chem. 42, 257-63 (1950) Feb.

The color, phototropy, and photoelectric oxidation phenomena of rutile are discussed on the basis of crystal chemistry of defect structures. Foreign ions, especially cations with a charge either higher or lower than that of Ti^{4+}, as well as the surface itself, represent defects of the crystals. An explanation is presented for the strong coloring effect of traces of Fe^{3+}, Cb^{5+}, W^{6+}, and other impurities in rutile. The reversible color change of titanium dioxide containing some ferric oxide is interpreted by a concept based on the electroneutrality of the lattice which has been used previously for explaining the electronic conductivity of the Nernst glower and the color of cerium dioxide contaminated with praseodymia. Photoelectric phenomena are typical of a combination of an easily polarizable anion with a strongly polarizing cation which, for oxides, usually has to be of the nonnoble gas type. The probability of electrons being released from anions increases with their polarization. The extreme effects resulting from one-sided polarization cause even silicon dioxide, or sulfates, to transfer electrons from surface oxygen ions to their

CHEMISTRY

cations. This photoelectric process leads to the formation of atomic oxygen which can be detected by its characteristic reactions, formation of silver peroxide, or oxidation of certain organic amines to dyestuffs. An especially sensitive test for atomic oxygen has been developed which detects photo-oxidation within very short exposure times. This test is based on the oxidation of 4,4',4"-hexamethyltriaminotriphenyl methane to the carbinol, which is the leuco base of the intensely colored crystal violet. (auth)

3695 The Relative Rates of the Reactions of Hydrogen Iodide and Deuterium Iodide with Methyl Iodide. Jacob Bigeleisen. AECU-753, nd. 5p.

The relative rates of reaction of protium and deuterium iodides with methyl iodide are treated by means of the general theory of the relative reaction velocities of isotopic molecules. The ratio of the rate constants can be expressed as a product of a temperature-independent and a temperature-dependent term. For an activated complex with no symmetry the temperature independent factor is 1.4, in good agreement with experiment. Comparison of theory and experiment furnishes a range of plausible values for two of the hydrogen frequencies in the activated complex. (auth)

3696 An Apparatus for the Micro-Electrolysis of Water. R. Bentley. Biochem. J. 45, 591-2(1950).

An apparatus is described in which quantities of the order of 1.5 ml of water may be electrolyzed and the evolved oxygen (or hydrogen) collected in a vacuum system. The apparatus is designed for use with deuterium and O^{18}.

3697 Condensations Effected by Boron Fluoride Complexes. III. The Acylation of Certain Substituted Thiophenes and Furans. Martin N. Farrar and Robert Levine. AECU-751, nd. 11p.

The boron fluoride method (Levine et al, J. Am. Chem. Soc. 71, 1207(1949)) for the synthesis of heterocyclic ketones has been extended to the acylation of 2-methyl furan, 2-methylthiophane, 3-methylthiophene, 2-chlorothiophene, and 2-bromothiophene with acetic, propionic, and butyric anhydrides. The acylations of 3-methylthiophene give rise to the formation of isomeric ketones, the 3-methyl-2-acyl and the 4-methyl-2-acyl derivatives. The former compounds are always produced in much higher yield than the latter. An explanation is offered to explain these results. In the acetylation of 2-chloro- and 2-bromothiophene two by-products are produced in each case, a β diketone, formed by the acylation of the ketone produced with acetic anhydride, and an aldol product, formed by the self-condensation of the ketone. 12 references. (auth)

3698 Bromine Trifluoride as an Ionizing Solvent. A. A. Woolf and H. J. Emeléus. J. Chem. Soc. 2865-71 (1949)Nov.

The existence of the ionic equilibrium $2\ BrF_3 \rightleftharpoons BrF_2^+ + BrF_4^-$ in liquid BrF_3 is supported by the isolation of "acids" and "bases" containing the BrF_2^+ and BrF_4^- ions, respectively. The compounds BrF_2SbF_6 and $(BrF_2)_2SnF_6$ behave as acids, and the bromofluorides $KBrF_4$, $AgBrF_4$, and $Ba(BrF_4)_2$ as bases. Conductivity measurements on BrF_3 solutions of these compounds are described, and it is shown by conduc-

CHEMISTRY

timetric titrations that neutralization reactions can occur to produce salts containing the SbF_6^- and SnF_6^{-2} anions. (auth)

3699 Evidence for a Non-Planar Carbon Ring in Octafluorocyclobutane. H. P. Lemaire and R. L. Livingston. J. Chem. Phys. 18, 569-70(1950)Apr (Letter to the editor).

Preliminary results of an electron diffraction investigation of the structure of octafluorocyclobutane have led to the conclusion that the four-membered carbon ring is nonplanar. It is indicated that the nonplanar ring in C_4F_8 may be attributed to repulsions between fluorine atoms attached to different carbon atoms. These repulsions may also be responsible for an increase in the C-C distance above the value which is observed in many hydrocarbons. (auth)

3700 Infra-Red and Raman Spectra of Fluorinated Ethylenes. II. 1,1-Difluoro-2,2-Dichloroethylene. J. Rud Nielsen, Howard H. Claassen, and D. C. Smith. J. Chem. Phys. 18, 485-9(1950)Apr.

The infrared absorption spectrum of gaseous 1,1-difluoro-2,2-dichloroethylene between 2 and 22.6 μ has been investigated with a prism spectrometer of high resolution. The Raman spectrum of $CF_2{:}CCl_2$ in the liquid state has been photographed with a three-prism glass spectrograph of linear dispersion 15A/mm at 4358 A. Quantitative polarization measurements have been made. The 12 fundamental vibration frequencies have been assigned, and the observed vibration spectra have been interpreted in detail. (auth)

3701 The Molecular Structure of Hexafluoropropene. F. A. M. Buck and R. L. Livingston. J. Chem. Phys. 18, 570-1(1950)Apr (Letter to the editor).

The electron-diffraction photographs of C_3F_6 were compared with the theoretical intensity curves of 65 different models. Planar models were not found acceptable, and the authors believe that the structure is best represented by a strained model in which none of the F atoms is in the plane of the 3 C atoms.

3702 An Automatic Potentiometric Titrimeter. R. A. Widing and J. Farquharson. AECD-2836, Dec. 23, 1949, Decl. May 2, 1950. 14p.

A titrimeter has been designed and constructed, which utilizes a motor-driven 50-ml hypodermic syringe in the reagent-feeding mechanism and a Leeds and Northrup Micromax recorder connected to the titration-cell electrodes through an amplifier. The high-low switch incorporated in the recorder is used to obtain the desired cutoff potential. The 95% confidence interval for the instrument, based upon 16 determinations of 85 mg of uranium in a volume of 200 ml, reduced in the Jones reductor and titrated with ceric sulfate solution, was $\pm 0.07\%$ of the average or $\pm 0.21\%$ on duplicate samples.

3703 Basic Techniques in th Use of C^{14} as a Tracer. I. Apparatus and Technique for the Wet Conbustion of Non-Volatile Samples. Cecil K. Claycomb, Tyra T. Hutchens, and John T. Van Bruggen. AECU-813, nd. 11p.

CHEMISTRY

The apparatus and technique described represent a procedure for the wet combustion of organic compounds in which high combustion efficiency is obtained, blank values are negligible, and adequate control over gaseous CO_2 is maintained. With this technique and with the range of combustion efficiency provided by it, it is possible to add carrier carbon either before or after combustion. In addition, the introduction of samples and the mixing of constituents is mechanically simple.

3704 Design and Construction of a Small Radioactivity Laboratory. Luther E. Preuss and John H. L. Watson. Nucleonics 6, No. 5, 11-26(1950) May.

In this practical paper the authors describe the setting up a radioactivity laboratory for general-purpose work on a limited budget. They conclude that it is cheaper to revamp an old building than to build a new one when a small laboratory is needed, but that when the project becomes large, the difficulties of conversion multiply too rapidly. Details of construction, materials, and instrumentation are given on the revamping of a suite of rooms in a hospital building.

3705 Chemical Reactions of Energetic Chlorine Atoms Produced by Neutron Capture in Liquid Systems. J. M. Miller and R. W. Dodson. AECU-787, nd. 36p.

The fraction of the radioactive energetic chlorine atoms, formed by radiative neutron capture, that reacts with inactive carbon tetrachloride to give radioactive carbon tetrachloride or with a solvent to give other radioactive organic halides, was studied as a function of composition in solutions of carbon tetrachloride in silicon tetrachloride, cyclohexane, and benzene. The reactions of similarly formed atoms were also studied for solutions of chlorine in cyclohexane and in benzene. No significant effect of the temperature of the bombarded solution or of the energy of the neutrons was found. The results are examined in terms of a theory which predicts the concentration dependence of some of the observed reactions, and alternative descriptions are suggested. It is concluded that the observed reactions occur before the recoil atoms are reduced to thermal equilibrium, and particular reactions predominate in certain energy ranges. 16 references. (auth)

3706 Isotope Effect on Bond Rupture by Electron Impact on Hydrogen, Deuterium and Tritium. Oliver A. Schaeffer and Julius M. Hastings. AECU-828, nd. 14p.

The relative yields by electron impact of atomic and molecular ions, x^+/x_2^+ peak ratios, from hydrogen, deuterium, and tritium have been measured with a 60-deg sector-type mass spectrometer. It is shown that the major part of the previous disagreement between calculated and observed values can be understood on the basis of voltage discrimination by the ion source. By using magnetic scanning and a high ion accelerating voltage the experimental ratios are: $H^+/H_2^+ = 0.013$, $D^+/D_2^+ = 0.0070$, $T^+/T_2^+ = 0.0036$ for 30-v electrons. These are compared with the calculated ratios: $H^+/H_2^+ = 0.019$, $D^+/D_2^+ = 0.0083$, $T^+/T_2^+ = 0.0044$. (auth)

3707 On the Fluctuating Concentration of X-ray Products in Water Dispersions. F. H. Krenz. Proc. Phys. Soc. (London) 63 B, 297-9(1950) Apr. 1.

It has been found that the partial pressure of decomposition gases over water irradiated with x-rays fluctuates more

or less regularly with the irradiation time. The experiments suggest that the fluctuations are caused by impurities in the water, and that this phenomenon is possibly related to the periodic rise and fall of electrophoretic mobility observed in the case of certain colloids when these are subjected to x-irradiation. (auth)

3708 Kinetics of Some Electron Transfer Exchange Reactions Involving Thallium and Cerium. R. W. Dodson, L. Eimer, J. Gryder, and G. Harbottle. AECU-791, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Exchange reactions between different oxidation states of an element may be considered primitive oxidation—reduction reactions. The kinetics of such processes have been investigated for the thallous-thallic and cerous-ceric systems in aqueous solutions. In both systems the rate of exchange is affected by the acidity of the solution, in general decreasing as the acidity is increased. The presence of anions which form complexes with the metal ions has a strong influence on the rate. These effects are explicable in terms of complexion and hydrolytic equilibria. The temperature coefficients show that the effects are found principally in the entropy rather than in the energy of activation. In the case of thallium, the exchange rate, over a wide range of conditions, is proportional to the product of the thallous and thallic concentrations, consistent with a bimolecular mechanism. A similar result is obtained for the cerous-ceric exchange in nitric acid solution; however, in perchloric acid the data suggest a reaction path in which the rate is proportional to Ce(III) but independent of Ce(IV), as well as a second-order path. An interpretation in terms of an excited state of cerous ion is advanced.

3709 Polonium Extraction Using a Platinum Electrode and Hydrogen. R. J. Prestwood. AECD-2839, Apr. 10, 1944, Decl. Dec. 16, 1949. 6p.

The electroplating of polonium from a RaD(Pb^{210}) solution onto a platinum electrode in a hydrogen atmosphere has been studied. A yield of 94% was obtained in 1 hr, during which 155 mc of Po^{210} was plated out on 10 cm^2 of Pt. Details of the procedure and a drawing of the apparatus used are given. (auth)

3710 Separation of Phosphorus^{32} from Sulfur^{32}. J. N. Butler. AECD-2850, Nov. 26, 1947, Decl. May 12, 1950. 21p.

Carrier-free radioactive phosphorus can be prepared in the pile by an (n,p) process on S^{32}. $S^{32}(n,p)P^{32} \xrightarrow[14.3d]{} S^{32}$ (stable). There are no by-products in this material except those formed from nuclear reactions of the chemical contaminants. About 2 kg of specially purified sulfur is irradiated in a large aluminum can in the pile for a period of at least 6 weeks. The contents of the can are melted out, and the active phosphorus is extracted with weak nitric acid under pressure at a temperature greater than 120°C, employing mechanical agitation. The waste molten sulfur and the active phosphorus extract are separated, and the latter is processed in order to remove chemical contaminants. Thus carrier-free active phosphorus produced in the pile is chemically separated from sulfur in multimillicurie quantities. (auth)

3711 Progress Report in Radiochemistry; May 1, 1949, to October 31, 1949. A. F. Voigt. ISC-78, Apr. 1, 1950. 14p.

Work is reported by the following topics: (1) studies on the separation of zirconium and hafnium; (2) complex organic compounds of zirconium; (3) extraction of ruthenium; (4) radioactivities of gadolinium (ion-exchange column studies and coincidence measurements); (5) separation methods for radioactive germanium; (6) impurity in radiophosphorus.

3712 Solvent Extraction of Inorganic Ions. Fourth Quarterly Progress Report. L. G. Bassett, S. E. Wiberley, J. Savolainen, and H. M. Clark. NYO-607, Feb. 1, 1950. 26p.

The evidence presented in this report indicates that other variables as yet undetermined as well as the ability of organic solvents to accept protons must be considered in evaluating their use in the extraction of inorganic salts. Heavy ethanol has been prepared, and its infrared spectrum in both the liquid and vapor state has been obtained. The shift of the bonded OD band has been measured in various ethers and has been correlated with the shift obtained with the OD band of heavy methanol and the C-D band of heavy chloroform in these same ethers. The spectra of numerous eithers have been run, using a lithium fluoride prism of high resolving power. Spectra of various uranium and thorium salts have been run in Nujol and have proved to be useful in the identification of bands found in ethers when these same salts are present. Data obtained from refractive index measurements made on aqueous ferric chloride solutions of known iron and chloride ratios show that in the range of concentration studied there is no indication of complex formation. A similar series of measurements on solutions of higher concentration is being made. 17 references. (auth)

3713 Anion Exchange Studies. II. Tantalum in Some HF-HCl Mixtures. Kurt A. Kraus and George E. Moore. ORNL-662, Apr. 26, 1950. 8p.

The ion-exchange behavior of Ta was studied (using radioactive Ta obtained by exposing Ta to slow neutron bombardment) for a number of HCl-HF mixtures. It was found to absorb very strongly under most conditions, even in 9M HCl. The ionic species TaX_5F^- and $HTaX_5F_3^{-2}$, where X represents a chloride, fluoride, hydroxide, or ½ oxide ion, have been tentatively identified, and the molarity constants for the probable reaction, $TaX_5F^- + 2HF + H_2O \rightleftharpoons HTaX_5F_3^{-2} + H_3O^+$, were estimated to be 2.5 and 0.53 for 9M HCl and 3M HCl solutions, respectively. (auth)

3714 Carrier-Free Radioisotopes from Cyclotron Targets. IX. Preparation and Isolation of $Re^{183,184}$ from Tantalum. Jeanne D. Gile, Warren M. Garrison, and Joseph G. Hamilton. UCRL-652, Apr. 10, 1950. 2p.

The long-lived radioisotopes of rhenium, $Re^{183,184}$ were produced by bombarding Ta with 40-Mev α-particles in a 60-in. cyclotron. Radioactive Re is preduced by the following reactions: $Ta^{181}(\alpha,n)Re^{184}$, $Ta^{181}(\alpha,2n)Re^{183}$, $Ta^{181}(\alpha,3n)Re^{182}$. The 46-day Hf^{181} is also produced by an (n,p) reaction. The

short-lived Re^{182} and a short-lived isomer of Re^{184} were allowed to decay before chemical separation, which is described in detail. Al and Pb absorption measurements showed a 0.2- and 0.8-Mev β particle and 1.0-Mev γ ray for Re^{184}. A 240-day half-life is reported for Re^{183}.

3715 Chemical Alteration of Polysaccharide from Serratia Marcescens. III. Reaction of Polysaccharide with Radioactive p-Iodobenzene Diazonium Chloride and the Use of the Product in an Experimental and Clinical Study. Arnold M. Seligman and Theodore Sack. J. National Cancer Institute 10, 105-18(1949) Aug. (See also NSA 1- 1736.)

The results of a study of the product of a reaction between a tumor-necrotizing bacterial polysaccharide derived from Serratia marcescens and radioactive p-iodobenzene diazonium chloride are presented; the reaction product was tested in mice for tissue distribution and in humans for toxicity. Aniline was first iodinated with I^{131} and diazotized and reacted with the polysaccharide in a single reaction vessel without isolating any of the intermediated; the product was found to contain the I^{131} as a label for the benzene azo groups. Following the intravenous injection of a small quantity of the reaction product dissolved in saline into a mouse, there was a rapid rate of disappearance of radioactivity from the circulation; highest concentrations of activity were found in the liver and lung, while tumor tissue contained the smallest concentration. The toxic reactions observed following the intravenous administration of the product were characterized by a severe pyrogenic response and some degree of peripheral circulatory failure, labial herpes simplex, postinjection weakness, and other phenomena, similar to those seen when the unmodified polysaccharide was given. 12 references.

3716 Some Studies in Reaction Kinetics with Isotopic Tracers. R. W. Dodson. AECU-763, Dec. 13, 1949. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The usefulness of isotopic tracers inheres in the fact that they are physically distinguishable from their isotopes, but, to a good approximation, chemically indistinguishable. In addition to conventional analytical applications, they have a special feature in that they permit the observation of reactions which produce no net chemical changes in the system, i.e., exchange reactions in which atoms of a given element are exchanged between different sites or states. Recent developments have shown that exchange reactions in solution between different oxidation states, sometimes called electron-transfer reactions, can be profitably studied with isotopic tracers. The information obtained with respect to these primitive oxidation-reduction reactions is relevant to current ideas on the factors which influence the rates of oxidation-reduction reactions in general. Kinetic studies on a thallous-thallic system and cerous-ceric system will be reported, and reference will be made to work on other systems involving metal ions and their complexes. It is found that the reactions are relatively slow, whether one or several electrons are involved in the transfer process. They are catalyzed by metals and are subject to specific anion catalysis, interpreted in terms of complex formation. Some

important factors regarding the utility and limitations of tracer techniques will be brought out in the discussion. (auth)

3717 Determination of the Mechanism of γ-Lactone Hydrolysis by a Mass Spectrometric Method. F. A. Long and L. Friedman. AECU-782, nd. 9p.

Samples of γ butyrolactone have been hydrolyzed in aqueous solutions containing 1.6% H_2O^{18} and either 3M sodium hydroxide or 0.8M sulfuric acid and the lactone reformed from the hydrolysis product. These lactone samples have been subjected to mass-spectrometric analysis, and the ion intensity patterns have been compared with that obtained from ordinary γ butyrolactone. On the basis of changes in the ion-intensity ratios for masses 88/86 and 58/56, it is concluded that both the acid catalyzed and basic hydrolysis of this lactone go by an acyl-oxygen bond split in accord with predictions based on the results for hydrolysis of aliphatic esters and β lactones. (auth)

3718 The Exchange Reaction Between Aluminum Chloride and Carbon Tetrachloride. Carol H. Wallace and John E. Willard. AECU-809, nd. 36p.

It has been found that the chlorine in aluminum chloride will exchange readily with that in carbon tetrachloride, chloroform, normal, secondary, and tertiary butyl chloride, and amyl chloride. This exchange is a convenient method of preparing chlorides of this type tagged with Cl^{36}. The exchange reactions with carbon tetrachloride and with chloroform occur rapidly even at the melting points of these compounds (−21 and −63°) if the aluminum chloride has been synthesized in situ on the vacuum system in the absence of moisture. At these low temperatures the reaction does not go to completion. When the temperature of the reaction mixture is raised to progressively higher values, the exchange goes progressively further toward completion. These results seem to indicate that only the outer layers of the very slightly soluble aluminum chloride are accessible to the carbon tetrachloride at low temperatures, but that the depth of the layer accessible increases with increasing temperature. Complete exchange with carbon tetrachloride was always observed when the reactants were heated at 100° for 2 hr or more if the "concentration" of aluminum chloride was greater than 10^{-3} m/liter. At lower "concentration" many experiments showed relatively little or no exchange. One of several possible explanations for this effect is that a solid aluminum chloride surface is required for exchange to occur. It is possible to obtain conditions under which no exchange occurs between aluminum chloride and carbon tetrachloride in the gas phase at 140°. Aluminum chloride which has been exposed to moisture does not exchange with carbon tetrachloride at the melting point or considerably higher temperatures, but at room temperature or somewhat above, exchange occurs at an easily measurable rate, much slower than that observed with the dry reactant. The exchange of the hydroxylated material stops short of completion except at elevated temperatures. The observations are consistent with the hypothesis that exchange occurs on the ionic aluminum chloride surface through adsorption and desorption of carbon tetrachloride molecules as a result of polarization of the molecules by the electrostatic forces at the surface of lattice. They appear to be inconsistent with the carbonium ion type of mechanism ($CCl_4 + AlCl_3 \rightleftharpoons CCl_3^+ + AlCl_4^-$)

commonly used to rationalize Friedel-Crafts reactions. Incidental to these exchange studies it has been found that silver chloride precipitated from water consistently retains about 1% by weight of occluded water even after heating in vacuum at 160° for several hours. It has been shown that as little as 10^{-6} mole of water may be quantitatively detected in a vacuum system by collecting and counting the radioactive hydrogen chloride formed by hydrolysis of radioactive aluminum chloride in the system. 11 references. (auth)

3719 Basic Techniques in the Use of C^{14} as a Tracer. II. Preparation of $BaCO_3$ Plates by Centrifugation. Tyra T. Hutchens, Cecil K. Claycomb, William J. Cathey, and John T. Van Bruggen. AECU-814, nd. 12p.

Details are presented of an apparatus and technique by which a high recovery of $C^{14}O_2$ is accomplished, consistent reproducible specific activities are obtained, and sample surfaces are smooth, uniform, and free from cracks. One to 2 hr is required for the plating of four aqueous carbonate samples for counting, but only a portion of this time is actually given to manipulation, the remainder being distributed over the several periods of centrifugation.

3720 Basic Techniques in the Use of C^{14} as a Tracer. III. A Semi-Micro Synthesis of C^{14}-Carboxyl Labeled Acetic Acid. John T. Van Bruggen, Cecil K. Claycomb, and Tyra T. Hutchens. AECU-815, nd. 15p.

Procedures for the synthesis of C^{14}-labeled acetate both by chemical and microbiological methods have been reviewed by Calvin, et al (Isotopic Carbon, New York, John Wiley, 1946). A small, compact, inexpensive, easily assembled apparatus is described, with which reproducible yields of 80 to 90% have been obtained by the method of carbonation of a methyl Grignard reagent on a fractional millimolar scale. The apparatus has three components, a CO_2 generator, a delivery tube, and a carbonation and distillation flask, all of pyrex glass. Data on five consecutive syntheses are presented.

3721 The Synthesis of L-Ascorbic Acid Uniformly Labeled with C^{14}. Aksel A. Bothner-By, Martin Gibbs, and R. Christian Anderson. AECU-820, nd. 3p.

The document is in abstract form; it is reproduced below in its entirety.

The synthesis of L-ascorbic acids isotopically labeled in different positions is of great interest in biochemical research. Recently Burns and King (Science, 111, 257 (1950)) have described a synthesis of 1-C^{14}-L-ascorbic acid. We wish to report the synthesis of uniformly enriched L-ascorbic acid. Our synthesis was patterned after that of Reichstein and Grussner (Helv. Chim. Acta, 17, 311 (1934)) adapted to working on a semimicro scale.

A mixture of uniformly enriched sucrose, glucose, and fructose was prepared by allowing bean leaves to photosynthesize for 24 hr in an atmosphere of $C^{14}O_2$. The sucrose was hydrolyzed, and a mixture consisting mainly of glucose was precipitated by the addition of absolute ethanol. The mixture, weighing 392 mg and having a specific activity of 1.4 μc/mg, was hydrogenated in an alkaline aqueous medium, using Raney nickel. The sorbitol produced was oxidized to sorbose with Acetobacter suboxydans by the method of Wells et al., (Ind. Eng. Chem., 29, 1385 (1937)). After the fermentation the organism was removed by centrifuging, and the supernatant

liquid was passed through Amberlite IR-100-H and Duolite A-4 ion-exchange columns to remove ionic impurities. Crystallization and decolorization with Darco G-60 gave 344 mg of pure sorbose, mp 163 to 165°.

The sorbose was diluted with 135 mg of carrier and acetonated, using freshly distilled dry acetone and sulfuric acid as a catalyst. The diacetonesorbose was extracted from unreacted material and monoacetone derivative with ether. Oxidation of the diacetonesorbose with 6% potassium permanganate was carried out in alkaline medium (Maksimov, J. Gen. Chem. (U.S.S.R.), 9, 936 (1939)), the unattacked material from the first oxidation being removed by ether extraction and reoxidized. The two batches were carried through separately to the last step. The reaction mixture was filtered and acidified to pH 2, after which the diacetone-2-ketogulonic acid was extracted with ethyl acetate and refluxed with water for 40 min to effect deacetonation. Lyophilization gave white, powdery 2-ketogulonic acid, mp 170 to 171°. The methyl ester was prepared by passing a large excess of diazomethane into a methanolic solution of the acid at −15°C. By crystallization from methanol acetone, 68 mg of white crystals, mp 145 to 150° was obtained. There was obtained in addition, 220 mg to residual oil, consisting partly of methyl 2-ketogulonate, which could not be induced to crystalize and was therefore diluted with 205 mg of carrier and carried through the last step. Treatment under nitrogen of the methanolic solutions of the ester with stoichiometric amounts of 4.65N sodium methoxide in methanol and 2.60N hydrogen chloride in methanol, gave, after purification according to the method of Szent-Gyorgyi (Biochem. J., 22, 1394 (1928)), 30 mg of L-ascorbic acid having specific activity of 0.80 μc/mg and 70 mg having specific activity 0.16 μc/mg. The products melted at 189 to 190° and gave a single spot of proper R_f value on a paper chromatogram.

3722 Study of Ion Exchange Resins with Radioactive Tracers—Separation of Lanthanum and Yttrium. Yang Jeng-Tsong. Analyt. Chim. Acta 4, 59-67(1950) Feb (in French).

Two French adsorbing resins have been studied by means of radioactive tracers. It has been found that the adsorbing power in ion-grams is inversely proportional to the valence of the adsorbed ion though constant to the ionic concentration in the solution. The adsorbing specificity of the employed resins was found to be very satisfactory. The elution and finally the separation of lanthanum and yttrium are performed by the ionographic method. (auth)

3723 The Spectrographic Determination of Uranium in Ores and Ore Products. David Kaufman and Carl W. Perkins, Jr. AECD-2834, Aug. 25, 1948, Decl. Apr. 25, 1950. 25p.

A spectrographic method for the determination of uranium in ores and products was investigated using a d-c arc for excitation. Direct burning of a 10-mg sample gave a sensitivity limit of only 0.05% U_3O_8 and was subject to numerous interferences. Simple chemical concentration procedures were also unsatisfactory. Complete separation of uranium by ether extraction gave consistent results; however, if complete separation of uranium is accomplished, colorimetric or fluorimetric methods of analysis are more convenient than spectrographic means. Selective volatilization of uranium as fluoride

CHEMISTRY

was unsuccessful. By the addition of silver chloride, most of the material was volatilized in a preburning period, and the uranium, which was not volatilized, was accurately determined down to 0.05% U_3O_8 on what was left. Incorporation of simple chemical concentration procedures prior to silver chloride volatilization should be tried. A few preliminary tests indicated that some increase in sensitivity can be provided by volatilizing the sample rapidly into the arc stream by the addition of lead or mercury salts. There are as yet no data to show whether or not this rapid volatilization will eliminate any of the difficulties encountered when using the other techniques.

3724 A Proposed Routine Method for Determining Uranium in Leach Liquors Containing Vanadium. James F. Shea, Frank Stephens, and A. C. Richardson. AECD-2838, Feb. 15, 1949, Decl. Mar. 15, 1950. 17p.

A method is described to shorten the time of analysis of uranium by eliminating either one or both of the precipitation steps used to free the uranium from vanadium, depending on the amount of vanadium present. The procedure consists in reduction of the uranium by means of bismuth amalgam and titrating the reduced solution by adding standard pentavalent vanadium solution in slight excess and determining the excess by back titration with standard ferrous iron solution. If the amalgam is re-used, reduction of the uranium takes a little longer. However, the controlling factor seemed to be the thoroughness with which the amalgam is dispersed into globules by means of shaking. The accuracy of the method decreases if vanadium is present in high proportions. 11 references.

3725 Preparation of Pure Oxides by Electrolysis. Marthe Dominé-Bergès. Ann. Chim. 5, 106-49(1950)(in French).

An electrolytic method of preparation of pure oxides and hydroxides is described, based on Jolibois' theory of the electrolysis of salt solutions, according to which, and contrary to the accepted views, the precipitation of a metal on the cathode is a secondary process, the primary reaction being the formation of an hydroxide that in many cases is precipitated upon the cathode. By using high voltages (up to 2,000 v), the cathode can be surrounded by pure water; the contamination of the hydroxide by foreign ions is thus avoided, and the product obtained is very pure. Through calcination the hydroxide can be converted into one or several oxides, the transformations from one oxide to the next one being controlled by a thermogravimetric setup. Among substances that are well adapted to this technique are uranium salts (nitrate and sulfate). The hydroxide obtained is $UO_3.H_2O$, which, upon calcination, yields UO_3 (amorphous), followed by a solid solution $UO_{2.90}$ (crystalline), then by U_3O_8 (crystalline); the latter presents two forms, one susceptible to a reversed process of reoxidation, the other nonreoxidable (see Boullé and Dominé-Vergès, Compt. rend. 227, 1365 and 1949 (1948); 228, 72(1949)).

ENGINEERING

3726 An Indirect Method of Process Control. Robert G. Durnal. AECD-2847, nd. Decl. Apr. 27, 1950. 13p.

This paper describes a method of servomechanism process control which is applicable to processes in which it is difficult or impossible to measure the primary variable to be controlled. It is best suited to processes in which the energy input is electrical in nature, but it is also applicable where the input quantities can be converted to electrical signals. The method of control involves the formulation of a secondary or indirect variable consisting of a product of electrical quantities. This secondary variable is then regulated by a servomechanism operating on the process input. Several means of generating the secondary variable are described and analyzed. A practical example of the method to a physical process, requiring the generation of the product $V^3\sqrt{I}$, is described. Block diagrams and photographs of the equipment are included. (auth)

3727 A System for the Collection and Purification of Radon by Remote Control. Chester H. Shiflett, Mark E. Steidlitz, and Wallace Davis, Jr. K-591, Apr. 17, 1950. 10p.

A plant for the collection and purification of Rn has been constructed. In order to reduce the γ-radiation level, the plant was designed to be operated entirely by remote control except for the final sealing of the Rn capsule. This plant compares favorably with other collection systems both with regard to the time required for a collection and to the yield of Rn obtained. (auth)

3728 An Automatic Control Valve for Fluorine Storage Tanks. T. W. Hungerford and D. C. Gary. ORNL-659, Apr. 14, 1950. 11p.

An automatic solenoid control valve to shut off the fluorine from supply cylinders has been designed. A mock-up using compressed air was tested successfully. At the present time two research laboratories are equipped with such automatic control valves on the fluorine storage tanks.

3729 Radium, Tantalum^{182}, and Cobalt^{60} in Industrial Radiography. James W. Dutli, Gerold H. Tenney, and John E. Withrow. Non Destructive Testing, 9-11(1949-50) winter.

The use of Ta^{182} and Co^{60} as sources of radiation in the field of industrial radiography has been investigated and compared with radium. The technique charts of the following elements have been developed for thickness up to 3 in.: aluminum, zinc, iron, tin, copper, and lead. The resolution, sensitivity, and half-value layers have been compared. It can be concluded that Ta^{182} behaves almost in the same manner as radium. Co^{60} offers better radiographic qualities in the case of heavier metals partly because of the greater intensity per unit volume. Ta^{182} and Co^{60} give better radiographic resolutions. (auth)

3730 Radioactive Isotopes in Industry; Emergence of Experimental and Practical Equipment. K. Fearnside. Chem. Age 62, 611-14(1950) Apr. 29.

A general discussion is presented on the nature and characteristics of radioisotopes; α, β, and γ radiations are described in detail. Such applications of the isotopes to industry as dissipation of the static charge built up during paper-mill operations and the control of paper thickness in paper-rolling process are discussed. Tl^{204} is mentioned as being an appropriate isotope for these purposes.

ENGINEERING

3731 Radioactive Tracers in Research and Industry. I. The Scope of Radiochemistry. L. Tordai. Mfg. Chemist 20, 313-17(1949) July.

A general discussion is presented on the nature of radioisotopes and their applications to semimicroanalysis, medical therapy and diagnosis, and manufacturing processes. The equipment necessary to set up a radiochemistry laboratory, the nature and use of the modern Geiger counter, dosage measurements and units, safety procedures, and waste disposals are also commented upon.

3732 Radioactive Tracers in Research and Industry. III. Radiochemical Methods in Inorganic Analysis. L. Tordai. Mfg. Chemist 20, 481-6(1949) Dec.

This article discusses the extreme sensitivity and good accuracy which can be achieved through the use of radiochemical methods in inorganic analysis. Errors in using Geiger tubes, or caused by the physical form of the test samples or by the disposition of the counter and sample, are discussed under separate headings and are evaluated. The author also describes the methods of inorganic analysis, activity analysis, and activation analysis as applied to radiochemistry; examples of radiochemical techniques are given, and some problems which lend themselves to radiochemical investigation are noted.

3733 Radioactive Tracers in Research and Industry. IV. Radiochemical Methods in Physical Chemistry. L. Tordai. Mfg. Chemist 21, 11-14(1950) Jan. (See also NSA 4-1437.)

Possible applications of radiochemical techniques to physicochemical problems are discussed; the requirements for each type of experiment are correlated to three properties of tracers, their radioactivity (R), the fact that they are isotopes of nonradioactive elements (I), and the fact that their detection can be done with great sensitivity (S). Three types of R-tecniques (or techniques where the radioactivity of the isotope is the only property made use of in the determination) are outlined: investigations on the role and mechanism of action of minute quantities of organic materials in altering the deposition of metal in electroplating; studies on labile molecules; and studies on the mechanism of fractional distillation. RI-technique applications include self-diffusion coefficient investigations and determinations of the vapor pressure of an organic liquid at low temperature; RS-techniques are applied to the problems of evaporation-condensation exchange in crystal growth. Mention is also made of the use of RIS methods for thermal diffusion studies. A later article will discuss radiochemical methods in organic chemistry

3734 Radioactive Tracers in Research and Industry. V. The Preparation of Radioactive Organic Chemicals. L. Tordai. Mfg. Chemist 21, 97-100(1950) Mar.

After discussing the theoretical aspects of exchange reactions between ordinary and radioactive atoms (labeling process), the author outlines methods of synthesizing radioactive organic compounds labeled with C^{14}; fermentation procedures are briefly considered. Reference is made to the allied field of radiation chemistry, including the Szilard-Chalmers process (Nature 134, 462(1934)).

ENGINEERING

3735 Construction and Applications of a New Design of the Philips Vacuum Gauge. F. M. Penning and K. Nienhuis. Philips Tech. Rev. 11, 116-22(1949) Oct.

The Philips vacuum gauge (Penning, Philips Tech Rev. 2, 201-8(1937)) is suitable for gas pressures of 2×10^{-3} to 10^{-5} mm Hg. In order to produce a vacuum gauge based upon the same principle, but useful for lower pressures, the electrode system has been replaced by another consisting of two parallel round metal disks as cathode and an anode in the form of a cylindrical jacket. To keep the distance between the pole shoes of the permanent magnet enveloping the glass tube as short as possible, this tube has been pinched where the cathode plates are mounted. These improvements have given the new instrument a sensitivity about 10 times as great; it covers a range from 10^{-4} to 10^{-6} mm Hg and can probably be used for pressures even below 10^{-7} mm Hg. Vacuum gauges are also used as leak detectors, and the method of incorporating a heated Pt tube for hydrogen detection is described.

MINERALOGY, METALLURGY AND CERAMICS

3736 Electroplating of Beryllium. M. Kolodney. AECD-2845, nd, Decl. Feb. 10, 1950. 3p.

A method is described for the preparation of Be prior to plating. An anodic etch in aqueous H_3PO_4 containing a small amount of HCl is followed by a short chemical etch in H_2SO_4. Mechanical and microscopic examination indicate excellent adhesion with Ag, Au, Cd, In, and Sn.

3737 A Metallurgical Investigation of Silver Chloride. R. D. Moeller, F. W. Schonfeld, C. R. Tipton, Jr., and J. T. Waber. AECU-811, Mar. 15, 1950. 53p.

The fact that metals are opaque to visible light has placed limitations on investigatory methods. Knowledge of metallurgical phenomena would be more readily attained if it were possible to observe and record the behavior of the interior of a metallic specimen during a reaction or test. An attempt is made to establish that AgCl, a transparent material, is sufficiently metallic in behavior to allow its use in metallurgical research. Existing data have been assembled, and supplementary information to provide a basis for investigation has been provided. Silver chloride can be cast, worked, and formed by common metallurgical techniques. Its deformation mechanism, mechanical properties, elastic constants, and such physical properties as compressibility, thermal expansion, and crystal structure are similar to those of many common metals. Differences from metals exist, such as electrical resistivity, because of ionic bonding. However, it is hoped that the similarities demonstrated are sufficient to encourage the use of silver chloride as a transparent metal in metallurgical research. 36 references.

3738 Alloys for High-Temperature Service; Quarterly Progress Report. Howard C. Cross. Battelle Memorial Institute, Sept. 16, 1949. 11p. (AEC File No. NP-1415.)

This report summarizes the work done during June through August, 1949. In the program to improve the room-temperature shock resistance of chromium-base alloys, 35 heats were prepared to study the effects of several variables. These are: type of crucible, type of chromium charged, pouring and mold tem-

peratures, deoxidation by aluminum or zirconium silicide, carbon and nitrogen contents, and heat-treatment. The bend-test results obtained to date on chromium-base alloys indicate that, the finer the grain size, the greater is the maximum bending stress (in tension). The investment casting of the 58Cr-15Fe-25Mo-2Ti type alloy is progressing. Tests made with molds consisting of beryllia refractory and acid or basic binders produced castings with smoother surfaces than any obtained thus far. The investigation of the efforts of nitrogen, iron, and nickel on the α-β transformation and γ precipitation in cobalt-chromium–base alloys was completed. Ternary cobalt-chromium–base alloys containing tungsten or molybdenum were prepared and homogenized. Creep-rupture tests on cobalt-chromium binary alloys were continuing. (auth)

3739 Kinetics of the Reactions of Columbium and Tantalum with O_2, N_2 and H_2. Earl A. Gulbransen and Kenneth F. Andrew. J. Metals 188, 586-99(1950) Mar.

The results obtained in the study on the kinetics of the gas-phase reactions of Cb and Ta with O_2, N_2 and H_2 are discussed. The effect of pressure on the oxidation reaction is small. The reactions of Cb and Ta with nitrogen were studied over the temperature range of 500 to 850°C. The reactions are not sensitive to pressure because a thin film of nitride is formed which limits the pressure from exerting its normal influence on the base metal. A study of the hydrogen reaction shows that the rate of reaction is a function of the square root of the pressure. 43 references.

3740 Studies of Recovery Processes for Western Uranium Bearing Ores: Part V. Tests of Specific Leaching of Carnotite Ores. C. F. Coleman. AECD-2846, Oct. 31, 1949, Decl. May 12, 1950. 16p.

The results of empirical leaching tests of various reagents on carnotite ores are summarized. Most of the reagents tested fall into four general classes—dicarboxylic acids, aryl ortho-hydroxy and -amino compounds, poly-hydroxy compounds and compounds related to the peptide linkage. Tables of results are presented. No reagent was found sufficiently effective and specific for practical use on low-grade ores.

3741 Studies of Recovery Processes for Western Uranium Bearing Ores: Part VII. Wet Concentration. D. J. Crouse and K. B. Brown. AECD-2849, Dec. 6, 1949, Decl. May 9, 1950. 34p.

Studies were made of the susceptibility of certain carnotite ores to wet concentration techniques. By scrubbing for long periods, over 90% of the U and V can be obtained in the slime concentrates. With brief scrubbing, about 75% of the values are obtained. Tests on the effect of surface active agents, using commercial wetting agents and detergents, on increasing the efficiency of the scrubbing action showed that none of them were materially superior to the simple water treatment. The slimes were found to be amenable to the usual mill processes for carnotite ores. Tables and graphs of results are included.

MINERALOGY, METALLURGY AND CERAMICS

3742 The Beryl Picker. James H. Pannell and Wilfred L. Freyberger. M.I.T. Mineral Engineering Laboratory Topical Report No. MITG-224, Sept. 20, 1949. 18p.

The preliminary development of a mechanism for automatically concentrating beryl ore, by use of the γ,n reaction, is described. A van de Graaff x-ray generator was used for the irradiation, and beryl was picked from a moving belt as it passed through the beam. Pieces of beryl weighing as little as 1 g each were picked at the rate of 5/sec. (auth)

3743 Germanium in Sphalerite from Nepal. J. Sci. Indust. Research (India) 9B, 52-3(1950) Feb.

It was found, spectroscopically, that Ge is present to about 0.24% in the magnetic portion of sphalerite samples. Since the occurrence of GeO_2, reported as 0.25%, in the concentrate from residues obtained during the melting of zinc ores is exploited in the United States, sphalerite is suggested as a good source.

PHYSICS

3744 100-Ton Test; Ground Vibrations. L. Don Leet. AECD-2840, Nov. 15, 1945, Decl. Nov. 15, 1949. 6p.

An analysis of all available records of the 100-ton shot of May 7, 1945, was made and it was concluded that there is no possibility of damage to property from ground vibrations from a 100-ton shot or any larger shot including 50,000 tons, for the proposed conditions of the test. For a 5000-ton shot the radius of potential damage from ground vibrations would be only 500 yards, much less than the radius for blast damage. For a 50,000-ton shot located 100 ft above the ground, the radius of damage from ground vibrations should not be greater than 1000 yards. (auth)

3745 100-Ton Test at Trinity. Report on Earth Velocity Measurements. J. H. Coon and H. M. Houghton. AECD-2841, June 13, 1945, Decl. Nov. 18, 1949. 10p.

Elastic earth motion at 800, 1,500, and 9,000 yards from the 100-ton Trinity shot was measured with velocity-type geophones. The report includes descriptions of the apparatus, the field layout, miscellaneous testing, and the method of analysis. Earth-particle velocities, displacements, and periods are given, along with a rough method for predicting elastic earth motion for charges not buried. (auth)

3746 100-Ton Test. Permanent Earth Movement; Earth and Air Shocks. W. G. Penney and F. Reines. AECD-2842, May 28, 1945, Decl. Nov. 15, 1949. 11p.

The earth-movement data obtained from a 100-ton shot are discussed and scaled up to the earth movement expected from the atom-bomb test. The results are of interest to people who will place instruments in the vicinity of the bomb. A curve showing the earth movement as a function of distance from the test shot is given.

3747 100-Ton Test; Mechanical Impulse Meter. Theodore Jorgensen, Jr. AECD-2843, May 31, 1945, Decl. Nov. 14, 1949. 10p.

PHYSICS

A mechanical gauge for measurement of peak pressure, impulse, and duration at the 100-ton test shot was set up at a distance of 200 yards, and a record was obtained. The apparatus is described, and the results are listed and discussed.

3748 Ground Vibrations from Trinity Tests. L. Don Leet. AECD-2844, June 24, 1945, Decl. Nov. 15, 1949. 5p.

An analysis of records of the 100-ton shot of May 7, 1945, combined with extensive tests on vibrations from quarry blasting, shows that there is no possibility whatever of damage to property from ground vibrations caused by either the 100-ton shot, a 5,000-ton shot, or a 50,000-ton shot. It is recommended that vibration measurements in nearby towns be made inside buildings to permit determination of the effect, if any, of air-borne concussion on the building as well as ground vibrations. (auth)

3749 Progress Report for September 1949. Carl G. Moore, D. S. McKinney, and J. C. Warner. NYO-542, Sept. 1949. 8p.

A titanium electrode designed for measuring the emf of reversible cells is described. Photographs and data are included.

3750 Comment on Mobility Anomalies in Germanium. G. L. Pearson, J. R. Haynes, and W. Shockley. Phys. Rev. 78, 295(1950) May (Letter to the editor).

It appears probable that the simple theory of spherical energy surfaces in the Brillouin zone for both holes and electrons in germanium may have to be modified in view of experimental results on mobility and magneto-resistance. The results of three methods of determining mobility are given as the drift, Hall, and conductivity mobilities with most probable values of 3,600, 2,600, and 3,350 cm^2/volt-sec, respectively, for electrons, and 1,700, 1,700, and undetermined for holes.

3751 The Interaction of Pi-Mesons. Oreste Piccioni. AECU-797, Feb. 23, 1950. 5p.

Experiments on the interaction of π mesons with nuclei show a very small cross section for nuclear absorption in flight. No evidence for a process in which the meson does not disappear is indicated. Further experiments are being performed on the cascading of π mesons in conjunction with the interaction of π mesons with nuclei.

3752 Stars and Showers at Baloon Altitudes. A. M. Thorndike and A. M. Wotring. AECU-798, Feb. 14, 1950. 6p.

Cloud-chamber observations of stars and showers at an altitude of 95,000 ft and magnetic latitude 55°N are reported. The term "star" denotes an event in which two or more heavily ionizing tracks diverge from a common point; "shower" denotes 300 or more lightly ionizing tracks diverging from a common point; "shower-star" is an event where showers and stars are both present. The results are consistent with the assumption that the majority of lightly ionizing tracks from shower-stars are mesons and consistent with the results obtained in emulsions. From observations on showers the authors conclude that primary electrons are rare or nonexistent, and that the small showers observed must arise from the nuclear interactions of the primary protons.

3753 Altitude and Latitude Dependence of Bursts in a Lead Shielded Ion Chamber. Allen J. McMahon and Bruno Rossi. AECU-823, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The instrument used in this experiment consists of a cylindrical ionization chamber covered by a half-cylindrical lead shell 15 cm thick and of six trays of G-M tubes, of which five are placed around the lead shield and one directly under the chamber. Various kinds of coincidences between bursts of the ionization chamber and pulses of the counter trays are recorded. These events are interpreted as due to nuclear interactions of cosmic rays. The instrument was installed aboard a B-29 and flown at the pressure altitudes of 273, 300, and 383 g cm^{-2} at 55°N geomagnetic latitude, and at the pressure altitudes of 300 and 383 g cm^{-2} at 20°N geomagnetic latitude. The experiment provided information on the altitude, latitude, and angular dependence of the radiation responsible for nuclear interactions. If one considers, in particular, penetrating ionizing particles capable of producing high-energy nuclear events after traversing 15 cm of lead, one finds that the altitude dependence corresponds to an absorption thickness of about 124 g cm^{-2} both at 55 and 20 deg and that the intensity ratio between the two latitudes is about 1.14. (auth)

3754 Excess of Positive Mesons in Cosmic Rays. D. E. Caro, J. K. Parry, and H. D. Rathgeber. Nature 165, 689(1950) Apr. 29 (Letter to the editor).

Preliminary measurements of the meson momentum spectrum are reported which were obtained by means of a cosmic-ray spectroscope involving the use of a magnetic field and of lead filters. For cosmic-ray particles at sea level, capable of penetrating 10 cm of lead, a differential momentum spectrum and the ratio of positive to negative particles are presented. The spectrum is in good agreement with that of Rossi (Revs. Modern Phys. 20, 537(1948)) except in the region of high momentum, where it decreases more rapidly.

3755 A Device for Making Point by Point Measurements of a Varying Frequency. R. L. Chase. AECU-768, nd. 1p.

This paper describes a device which measures radio frequencies in the range of 100 kc to 5 Mc to an accuracy of 0.1% in an interval as short as 200 μsec. The method used is to count the number of cycles from a 5-Mc standard oscillator, which occur in a time interval corresponding to a selected integral number of cycles of the unknown frequency. The precision of the measurement increases linearly with the duration of this time interval. The system is particularly useful for measuring instantaneous values of frequency from a variable frequency source when a measurement of short time duration is essential. Results of some frequency measurements with the instrument are included. Application of the instrument to evaluation of r-f control systems for synchrotrons is discussed.

PHYSICS

3756 Modification to Weston 877 Densitometer. E. F. Hassell, R. C. Roth, and C. F. Stearns. AECU-788, Jan. 13, 1950. 2p.

A description and a construction drawing of a ball and pivot arrangement to replace the standard bearings on the Weston 877 Densitometer to permit accurate alignment and readjustment to compensate for wear are presented.

3757 Isotope Abundance Measurements. G. H. Palmer. Atomic Energy Research Establishment Report No. AERE-G/R-464, Jan. 1950. 9p.

The report is concerned with some measurements on the isotopes of a number of substances, principally of masses below 70, using a mass spectrometer. The mass spectrometers used were built by Metropolitan Vickers (type MS1) and were based on a design of A. O. Nier. No real attempt has been made to measure absolute abundances, the work in hand being principally interested in the change of isotopic constitution of one sample relative to another. The accuracy of results and the limitation to accuracy are discussed, and some observations are made on the use of the spectrometer as a gas analyzer. (auth)

3758 Mass-Spectrometric Analysis of Isotopes and Gases. A. V. Trofimov. Zhur. Analiticheskoĭ Khim. 5, 58-72(1950)(in Russian).

A general outline is given of the methods of isotopic and gas analysis with the aid of the mass spectrometer. Several types of this instrument and of the accessory equipment are described, the sources of errors are discussed, and the characteristic methodological differences between isotope determinations and gas-mixture analyses are enumerated. 17 references, mostly American.

3759 A Radio-Frequency Spectrograph and Simple Magnetic-Field Meter. R. V. Pound and W. D. Knight. AECU-760, nd. 19p.

A simple oscillating circuit with a special feedback circuit is employed as a tool for the search for and detailed analysis of nuclear paramagnetic absorption lines. The sensitivity approaches the optimum for a given noise bandwidth, and particularly useful is the ease of conducting slow, continuous changes of frequency while recording the output data. Spectra having several components at scattered frequencies are thus displayed. Line shapes are unambiguously recorded because of the absence of sensitivity to dispersion. With protons in water, or solutions containing Li^7, the device can be used as a versatile and extremely precise meter for measuring magnetic field strengths in the range from about 100 to 25,000 oersteds with a minimum of auxiliary equipment. 14 references. (auth)

3760 A Proportional Counter X-ray Spectrometer. W. Bernstein, H. G. Brewer, Jr., W. Rubinson. AECU-769, nd. 20p.

A proportional-counter spectrometer for use with x-rays in the energy range of 1 to 50 kev has been constructed. The electronic circuits and counters are described in detail. The effects introduced by the counter materials and filling gas are explained, and the resolution and linearity of the instrument are described. Use of the instrument is illustrated by the x-ray spectra of several radioactive sources. (auth)

PHYSICS

3761 Magnetic Electron Multiplier for Detection of Positive Ions. Lincoln G. Smith. AECU-773, Nov. 4, 1949. 11p.

A 15-stage magnetic electron multiplier, using beryllium copper dynodes for detection of weak beams or pulses of positive ions, is described. The instrument makes use of a magnetic field to focus secondary electrons from one dynode onto the next. This multiplier has proven a highly useful detector in a time-of-flight mass spectrometer. Advantages of this design over previously described magnetic multipliers are the use of a smaller number of plates, less tendency for breakdown and noise due to ion feedback, and smaller spread in transit time, and hence probably a shorter response time. This design also is superior to electrostatic multipliers in the latter two respects. (auth)

3762 A Monitor for Low Intensity Gamma Rays. J. B. H. Kuper and R. L. Chase. AECU-783, nd. 12p.

A recording monitor for low-intensity γ radiation has been developed, using a simple and inexpensive form of dynamic condenser electrometer in connection with an ionization chamber and a commercial recording potentiometer. Use of a rate of drift method at relatively low-voltage sensitivity eliminates difficulties with contact potentials and grounding-key kicks. The instrument gives an indication and recycles when 5 μr have been received. Normal γ background current is 4 to 5×10^{-15} amp, and at this sensitivity the instrument is extremely rugged and operates outdoors in all weather. (auth)

3763 Monitor for Airborne Radioactive Dust. J. B. H. Kuper, E. H. Foster, and W. Bernstein. AECU-800, nd. 8p.

This paper describes a continuous monitoring instrument of which several have been constructed and operated at Brookhaven for studying the natural radioactive background and its daily variations. A strip of filter paper is moved continuously across an aperture through which the air to be monitored is pumped. After dust collection the paper passes one or more counters. The standard Brookhaven arrangement utilizes one mica-window β-γ counter which sees the dust sample about 1 hr after collection and an α counter which sees the sample about 4 hr later. The apparatus is so designed that additional counters can readily be used, or the time sequence of the various counts readily altered from a minimum of about ½ hr to a maximum of about 18 hr following collection.

3764 A High Speed Expansion Valve for Cloud Chamber Control. R. P. Shutt and W. L. Whittemore. AECU-827, nd. 17p.

Whenever accurate measurements are to be performed on a cloud-chamber photograph, it is important to keep the width of the tracks to be measured down to less than 1 mm. Considering ion diffusion, it is found that in air or argon the time delay between passage of a ray through a cloud chamber and completion of an expansion must be 10^{-2} sec or less. A newly designed valve is described which combines large size of the valve air duct with a short opening time, small electric power requirements, and simple operation. By applying the principles involved twice in succession, an even larger valve could be controlled with a small amount of power, and

it would still have sufficiently fast expansions. A number of operating characteristics for the valve are calculated from theoretical considerations for comparison with experimental data.

3765 Causes of Abnormal Efficiencies in Scintillation Counters. W. G. Cross. Phys. Rev. 78, 185-6 (1950) Apr. 15 (Letter to the editor).

Experiments were carried out to determine the relative influence of various factors which may produce abnormally high counting rates in scintillation counters used for the detection of β and γ rays. The various causes investigated were the scattering of γ rays, delayed pulses produced in the photomultiplier tube or crystal, and multiple pulses from overloaded amplifiers.

3766 Counting of Elementary Particles and Quanta with the Electron Multiplier and a Scintillation Screen. Ewald Fünfer. Z. Naturforsch. 4a, 672-82(1949) Dec. (in German).

The properties of a scintillation counter, consisting of an electron multiplier and a scintillation screen were examined. A zinc sulfide screen was found suitable for the counting of α particles, the efficiency of counting being 100% above a certain energy. For β and γ radiation from radium naphthalene and anthracene, scintillation screens with a thickness of several millimeters were employed. When cooling the screens it was possible to obtain a counting rate for γ rays exceeding by a factor of 10 that obtained with a Geiger counter. By means of an oscillogram analysis of the amplifier pulses, the author determined the duration of the scintillation pulses, which was 10^{-7} sec for anthracene. The amplitudes of the pulses obtained from the amplifier varied considerably. Their distribution function permits conclusions as to the number of electrons initiating the counting process in the electron multiplier, and one can obtain from it an indication of the radiation energy absorbed by the scintillation screen.

3767 Counting of Pulses Recorded on a Steel Wire. T. Franzini and L. Musumeci. Nuovo cimento 7, 159-60 (1950)(Letter to the editor)(in Italian).

A study was made of the possibility of magnetically recording the pulses of a Geiger-Mueller counter on a steel wire. The absence of a mechanical counter in the setup permits the recording of higher numbers of pulses per unit time than can be done in the usual devices. The wire is then played back at a lower velocity compatible with the properties of a mechanical counter.

3768 Decay Time of Stilbene Scintillations as a Function of Temperature. R. F. Post and N. S. Shiren. Phys. Rev. 78, 80-1(1950) Apr. 1 (Letter to the editor).

Using 931-A photomultipliers and a pulsed-counter technique, the authors have photographed scintillation pulses from trans-stilbene and have used these to obtain decay-time data at isolated temperatures down to that of liquid nitrogen. The observed pulse rise times were about 10^{-9} sec. Since this time is considerably shorter than the measured decay times, the data were analyzed simply by comparison of the photographed pulses (smoothed by tracing) with plotted exponentials. The experimental arrangement is described in detail, and decay times are given for −196, −78, and 27°C.

Measurements were also made to determine the decay times of pulses in anthracene crystals for the same temperatures, and these are also listed. At low temperatures the values for anthracene are in good agreement with the values given by Kelley and Goodrich (Phys. Rev. 77, 138(1950)), but discrepancies appear at higher temperatures.

3769 The Effect of the Presence of a Magnetic Field on the Functioning of Geiger-Mueller Counters. P. Bassi, I. Filosofo, and L. Prinzi. Nuovo cimento 7, 83-93(1950)(in Italian).

An experimental study of the behavior of Geiger-Mueller counters placed in a magnetic field showed that a field of 8,000 gauss, placed parallel to the axis of the counter, increases the number of pulses that are delayed ~ 1 μsec, the delay being due to the intrinsic lag in the counter between the passage of the ionizing ray and the pulse current, (Montgomery et al, Phys. Rev. 56, 635(1939)). Another effect produced by a magnetic field parallel to a counter is a decrease in the effective length of the latter. No such changes are observed when the magnetic field is perpendicular to the axis of the counter. The recovery time of the counter is not affected by the presence of the field. An interpretation of these facts, in the frame of the current theory of the discharge in the Geiger-Mueller counter, is given. (auth)

3770 Gold Sensitization of X-ray Films. Herman Hoerlin and F. W. H. Mueller. J. Optical Soc. Am. 40, 246-51(1950) Apr.

Sensitization of nonscreen-type x-ray emulsions with aqueous solutions of ammonium or alkali aurous thiocyantes leads to a wavelength-dependent increase of their x-ray and γ ray sensitivities. For a particular fine-grain emulsion the gain in photographic speed is shown to increase from a factor of 1.5 at 1.3 A to a factor of 10 at 0.011 A. A comparison of the quantities of latent image silver formed by light exposure, on one hand, and by electrons, on the other, indicates that gold sensitization increases the effective radius of action of the sensitivity centers and also the number of active centers at the grain surface. (auth)

3771 Ionization in Gases — the Ionization Chamber and the Geiger Counter. T. H. D. Attewell. Electronic Eng. 21, 450-6(1949) Dec.

The author gives a picture of the process of ionization and examines the energy relationships of an electron with the atom of which it forms a part. Specifically the author discusses negative ions, mobility and recombination of ions, the Townsend avalanche, ionizing agents, classification of counters, the ionization chamber, detection of β particles, the guard-ring and insulator, and Geiger counters.

3772 Large-Area Scintillation Counters. R. Batchelor, J. W. Smith, and L. Blackmore. Nature 165, 688(1950) Apr. 29 (Letter to the editor).

Some optical device is required to ensure that the light produced in different regions of a crystal used for scintillation counting is collected by the phototube in a uniform and efficient way. A cone, paraboloid, hemisphere, and a sphere were compared by scanning the plane, which would normally contain the large crystal, with a small anthracene crystal

PHYSICS

behind which was fixed a polonium α source. It was found that the best results were obtained with an integrating sphere having a highly reflecting diffuse white surface of magnesium oxide. Such a system was found to have an efficiency twice that of a specular reflecting system of the same dimensions.

3773 Liquid Scintillation Counters. George T. Reynolds. Nucleonics 6, No. 5, 68-9(1950) May.

The scintillation properties of a series of solutions have been investigated. Terphenyl in m-xylene for example, at 0.5g/100 cc, gave a figure of merit of 0.79 compared with 0.90 for a good naphthalene crystal. Oscilloscope pulses from terphenyl were a little larger than one-half those from an anthracene crystal. Because large cells of clear solution can be simply prepared, it will now be possible to perform cosmic-ray experiments requiring large, fast detectors.

3774 A Mathematical Analysis of C. M. Witcher's β-ray Spectrometer of a Type Using Helical Orbits. Yujiro Koh. J. Phys. Soc. Japan 4, 245-51(1949) Dec.

An analysis is made of the baffle configuration for a helical orbit β-ray spectrometer. The geometry for source, baffles, and detector is calculated for greatest luminosity and resolving power.

3775 The Measurement of Radioactivity in Solution. George K. Schweitzer. J. Tenn. Acad. Sci. 24, 123-5(1949) Apr.

Three methods of measuring radioactivity in solution are described and compared quantitatively. Open solution counting detects the lowest energy particles of any of the three; the enclosed solution method is safest with least danger of spillage or contamination, and a constant volume is readily attained; the dipping counter method is the least efficient.

3776 A New Type of β-Ray Spectrograph. O. Kofoed-Hansen, J. Lindhard, and O. B. Nielsen. Kgl. Danske Videnskab. Selskab Mat.-fys. Medd. 25, No. 16, 1-27 (1950)

An axially symmetric β spectrometer with source and focus on the axis of symmetry and outside the magnetic field is discussed, the advantages of the type chosen being large solid angle and a considerable number of different solutions with focusing. The actual spectrograph will contain many gaps between pole pieces with plane faces, having the general form of an interrupted toroid. The properties of a very crude model with one gap were investigated and showed agreement with the theory. The final spectrograph with six gaps is expected to have a solid angle of about 20% of 4π.

3777 On the Statistics of Electron Multipliers. Fritz Sauter. Z. Naturforsch. 4a, 682-91(1949) Dec. (in German).

On the assumption that the amplification of an electron multiplier and its fluctuations are subject to a certain probability law, one can formulate a general relationship between the amplitude distribution curves of the pulses entering and leaving the electron multiplier. Experimental evidence leads one to assume an exponential probability law for the amplification. When applying this law to several situations realized experimentally (Fünfer, Z. Naturforsch. 4a, 672(1949)), distribution functions for the amplitudes of the pulses entering the electron multiplier were determined.

PHYSICS

3778 On the Velocity of Discharge Propagation in Externally Quenched Geiger Counters. C. Balakrishnan and J. D. Craggs. Proc. Phys. Soc. (London) 63 A, 358-66(1950) Apr. 1.

A new method for measuring the propagation velocity of the discharge along a Geiger nonproportional counter is described. The results obtained with cylinder-grade argon, hydrogen, and neon are summarized graphically, and a brief discussion of propagation mechanisms is given. (auth)

3779 The Photographic Plate as a Measuring Instrument in Nuclear Physics. Erwin Schopper. Physik. Blätter 6, 112-22(1950)(in German).

This is a review of the application of nuclear emulsions in experimental nuclear and cosmic-ray research. The energy loss and range-energy relation of elementary particles in various makes of emulsions (Kodak, Ilford, Agfa) are discussed. A number of illustrations are given of nuclear and cosmic-ray events (stars), with suggested interpretations.

3780 Properties of Scintillation Materials. Nucleonics 6, No. 5, 70-3(1950) May.

The data on the important scintillation crystals tested to date, presented by Robert Hofstadter of Princeton University at the American Physical Society meeting at Brookhaven on April 1, are given here in two tables. "General Properties of Crystals" lists, among others, the light yield compared with that of anthracene and the linearity of response to various particles. "Light Yield Properties of Aromatic Molecules" gives a similar comparison and also the quantity $\Delta K/M$, where ΔK is the difference between the principal diamagnetic susceptibility along the normal to the plane of the molecule and the average susceptibility in the plane. M is the molecular weight. $\Delta K/M$ is a rough guide to the fluorescent yield.

3781 Radioactivity Surveying and Monitoring Instruments. Denis Taylor. J. Sci. Instruments 27, 81-8(1950) Apr.

This article is similar to one which appeared in Atomics 1, 5(1950) and which was listed in Nuclear Science Abstracts as Abstract No. 4-1775.

3782 A Stabilized Voltage Supply and Linear Amplifier for Photomultiplier Tubes. W. S. Plymale, Jr., and D. F. Hansen. Naval Research Laboratory Report No. NRL-3555, Oct. 12, 1949. 14p.

In experiments involving light detection, a need often arises for an a-c instrument to utilize readily the sensitivity of photomultiplier tubes. A single panel for the operating controls and portability of the apparatus are desirable features, especially in photometric work. An apparatus is described which is easily adjusted, gives stable operation on a-c lines, and is reasonably compact. A power supply using electronic voltage stabilization and control provides a dynode voltage which can be varied from approximately 80 to 100 v/stage. A bridge circuit with high impedance input amplifies the current from the phototube, so that an optimum over-all performance is obtained with a meter or recorder in the output circuit. Dark current is easily balanced out for any multiplier tube, and an eight-position gain switch, with a stage-to-stage linear ratio of 5x, is used to control the sensitivity. A given calibration is maintained by slight adjustments of the dynode voltage. (auth)

PHYSICS

3783 Ground-level Measurements of Oil-Fog Emitted from a Hundred Meter Chimney. Meteorology Group, Brookhaven National Laboratory. AECU-826, nd. 15p.

Data obtained by the Meteorology Group at Brookhaven National Laboratory from 30 smoke runs made between January and November, 1949, are presented. The oil fog is produced by a United States Army M-1 smoke generator and is forced up a 20-in. in diameter steel chimney 355-ft high at the northwest leg of the 420-ft tower at Brookhaven. It consists of oil droplets whose mean radius is 0.3 μ. The ground-level oil fog concentrations are measured with two photoelectric densitometers. The effective range of concentration which can be measured by the densitometers varies from 0.001 to 50 mg/m^3. The average oil-equipment dust content of the air is generally between 0.007 and 0.015 mg/m^3. Three types of concentrations have been computed from the densitometer readings at a fixed point on the ground: (1) the instantaneous maximum, i.e., the peak reading during the passage of a smoke eddy; (2) the mean concentration while smoke is present; (3) the concentration for 30 to 60 min, including periods when no measurable concentrations are observed. The mean concentrations are obtained from a planimeter analysis of a plot of concentration against time, subtracting the mean dust background for the period of observation. Wind and temperature are measured at various levels on the 420-ft tower. When an oil-fog test is under way, all wind recorders are run at a chart speed of 3 in./min.

3784 The Dispersion and Spreading of Gases and Dusts from Chimneys. Ward F. Davidson. Trans. Bull. 13, 38-55. Pittsburgh, Industrial Hygiene Foundation, 1949.

The present paper is a summary of available data and information on the dispersion and spreading of gases and fine dusts discharged into the atmosphere from chimneys. The discussion considers separately cases where aerodynamic factors, such as the influence of buildings on the pattern of air flow, predominate and cases where meteorological factors, such as atmospheric "stability" and turbulence, predominate. In any actual situation both must be considered. (auth)

3785 Hyperfine Structure and Exchange Narrowing of Paramagnetic Resonance. C. H. Townes and J. Turkevich. AECU-774, nd. 4p.

This is not an abstract; the document is reproduced below in its entirety.

The free radical α, α-diphenyl β-picryl hydrazyl, $(C_6H_5)_2N\text{-}NC_6H_2(NO_2)_3$, shows the strongest and narrowest electronic paramagnetic resonance absorption so far reported. This resonance was observed by its effect on the transmission of microwaves (frequency approximately 24,000 Mc) through a TE_{01} cavity with a small amount of the free radical placed approximately on the axis of the cavity. The microwave frequency was tuned to give maximum transmission through the cavity while the cavity was in place between the pole pieces of an electromagnet. With an amount of the free radical as small as 2 mg the transmitted power was reduced by a factor of 3 when the magnetic field was of the proper value (approximately 8600 oersteds) to give resonance. The half-width of this resonance at half maximum absorption was 1.45 oersteds. Because of its sharpness and intensity, this resonance may be of value for stabilizing or measuring magnetic fields in cases where the signal produced by the proton resonance is not sufficiently strong.

The electronic g value was obtained by measuring the electron's resonant frequency and the proton frequency in the same magnetic field. The ratio of proton to electron frequencies obtained was 15.178×10^{-4} which, combined with results of Taub and Kusch (Phys. Rev. 75, 1481(1949)), gives a g-value of 2.0042 ± 0.0004. The g value and line width obtained are in fair agreement with the results of Holden et al, who have made measurements parallel to those presented here, and with whom we have enjoyed very helpful discussions.

The usually narrow line width observed is evidently due to exchange narrowing (Van Vleck, Phys. Rev. 74, 1168(1948)) since spin-spin interactions alone would lead one to expect a half-width of approximately 50 oersteds. The free radical was dissolved in concentrations of 3.0 and 1.5 wt% in benzene, and the resonance width was examined. With these dilutions, exchange effects should be negligible, and indeed the resonance half-widths (half-width at half maximum) were greater than in the solid, being 7.5 and 5 oersteds, respectively, for the two solutions. These latter widths are, as closely as can be calculated, just those to be expected from spin-spin interactions. Motion of the molecules in solution gives no appreciable narrowing of the line at the frequencies used, since the relaxation time is 10^{-10} sec or larger.

Gaseous NO has been examined by Beringer and Castle (Phys. Rev. 76, 868(1949)) with a somewhat similar technique. They find associated with the electronic resonance a hyperfine structure due to coupling between the N^{14} and electronic magnetic moments. If the odd electron in NO is considered to be on the nitrogen atom in an essentially atomic 2 p state, the expected interaction is approximately 75 I. J. Mc/sec. Here the average inverse cube of the electron's distance from the nucleus has been taken from a previous estimate for nuclear quadrupole effects (Townes and Dailey, J. Chem. Phys. 17, 782(1949)). The experimental results give an interaction of 31 I. J. Mc, indicating that the probability of finding the odd electron on the nitrogen atom is approximately ½. This is what may be expected if the electron participates in a 3-electron band (Pauling, Nature of the Chemical Bond, Cornell Univ. Press, 1945).

The free radical examined here is in a $^2\Sigma$ electronic state, and the odd electron might be assumed to be in a 2 p orbit on the nitrogen atom which has only two bonds. In this case hyperfine structure consisting of three equally spaced, equal intensity lines separated by 125 Mc or 45 gauss may be expected. If exchange interactions between the electrons in adjacent molecules are as large as the electron-nuclear coupling, this hyperfine structure may be considerably modified or eliminated. Since exchange effects are evidently important in the solid material, failure to find hyperfine structure is perhaps not surprising. However, in the diluted solutions of the free radical hyperfine structure of the type described was expected, but not found. What hyperfine splitting is present must be less than the line width, hence the probability of finding the odd electron on the nitrogen which formally has only two valence bonds must be less than 0.15. In order to produce such a small hyperfine structure, this electron must either have considerable probability of being found on nuclei of zero spin such as oxygen, or perhaps

PHYSICS

circulate over a considerable region of the molecule and hence average out a large number of small interactions with nuclei.

Study of the hyperfine structure in other molecules with magnetic moments of electronic origin should give considerable information about the electron distributions.

3786 Microwave Absorption Spectra of POF_3. Samuel J. Senatore. Phys. Rev. 78, 293-4(1950) May. (Letter to the editor).

The lowest rotational transition of the POF_3 rotational spectrum ($J = 0 \rightarrow 1$, $K = 0$, $v = 0$) has been observed in Stark fields as high as 9.26 esu. With these high fields, the line is shifted 330 Mc/sec. No departure from the expected quadratic Stark law has been observed with these high fields. The line frequency may be given by the expression,

$$\nu = 9186.99(\pm 0.04) + 3.507E^2(\text{Mc/sec}),$$

where the applied electric field is given in esu. (auth)

3787 Microwave Measurements on the Stable Selenium Isotopes in OCSe. S. Geschwind, H. Minden, and C. H. Townes. Phys. Rev. 78, 174-5(1950) Apr. 15 (Letter to the editor).

From a re-examination of the $J = 2 \rightarrow 3$ transition in OCSe the relative masses of the stable Se isotopes have been determined, and an upper limit of 0.002×10^{-24} cm^2 has been assigned to the quadrupole moments. The experimental masses are compared with those predicted by the theory of Bohr and Wheeler. The agreement is rather good, although there are some discrepancies larger than the limits of experimental error.

3788 Neutron Diffusion Theory. Integral Theory Methods and Formulae. Bengt Carlson. AECD-2835, Dec. 15, 1949, Decl. May 2, 1950. 38p.

An integral equation for the one-velocity neutron flux as a function of radial distance in a spherical assembly in which anisotropic scattering occurs is derived by calculating the emerging angular flux by expanding the angular neutron flux in a series of spherical harmonics. Using an iterative method of G. Placzek, the author calculates the critical radius, a, of a bare sphere by expanding the flux n(r), where r is the radial distance, as a polynomial in even powers of $\frac{r}{a}$. The even moments, $M_m(a)$, m = 0,2 — — — N, of n(r), N being the subscript of the last term of the polynomial of n(r), is defined by $M_m(a) = \int_0^a r^m\, n(r)\, r^2 dr$. The corresponding moments $M_m^*(a)$ of the first iterate $n^*(r)$ of n(r) are calculated by substituting the polynomial of n(r) in the integral equation previously derived. Equating $M_m(a)$ and $M_m^*(a)$, (N/2) + 1 homogeneous equations in (N/2) + 1 unknowns are obtained. The solution of the determinant gives the eigenvalues of a. The method is used also for a case involving plane geometry. Tables of the functions occurring in the determinant are given.

3789 Relative High Energy Neutron Yields from Targets Bombarded with Protons and Deuterons. William J. Knox. AECD-2837, Sept. 12, 1949, Decl. May 4, 1950. 29p.

PHYSICS

Relative neutron yields in the forward direction from various target elements bombarded with 350-Mev protons and 190-Mev deuterons have been measured. Bismuth fission chambers with a threshold of about 150 Mev were used to detect the high-energy neutrons. The actual flux of protons or deuterons traversing each target was determined from the activities induced in graphite monitors attached to the target. When a deuteron beam is used, the neutron yields for light elements agree with the values predicted by the deuteron stripping theory. For the heavy elements the observed values are fitted best by adding a function proportional to Z^2 to the stripping theory values. This may be interpreted as evidence for the production of high-energy neutrons by the electric-field disintegration of the deuteron. The neutron yields from the proton beam vary approximately as $(A - Z)^{2/3}$ for target elements from carbon to uranium. This indicates that the heavy elements are not completely transparent to 350-Mev protons. Beryllium has an anomalous neutron yield 50% higher than that for carbon. Calculations and measurements on the problem of multiple traversals of beam particles through thin targets are presented. 13 references. (auth)

3790 Total Cross Sections for 280-Mev Neutrons. I. R. Fox, C. Leith, L. Wouters, and K. R. MacKenzie. AECD-2848, Jan. 26, 1950, Decl. May 9, 1950. 17p.

The measurement of 280-Mev neutron cross sections of various nuclei is described. The neutron beam used was obtained from 340-Mev protons in the 184-in. cyclotron striking a 2-in. Be target. The neutron detector consisted of a double coincidence anthracene scintillation counter telescope which counted recoil protons scattered at 15 deg from a paraffin cylinder placed in the collimated neutron beam. A 2-in. Cu absorber placed between the counters assured that only protons of energy greater than 250 Mev were counted. The cross sections for all nuclei measured from Li to Pb are smaller than the corresponding cross sections measured at 90 Mev (Cook, et al, Phys. Rev. 75, 1(1949)) by factors between 0.5 and 0.6. The curve for the "nuclear radius" as a function of $A^{1/3}$ for 280-Mev neutrons, where R is calculated from $\sigma_t = 2\pi R^2$ gives a straight line. This is in contradiction with the nuclear transparency theory which predicts a higher cross section for elements of large A than was actually observed. (auth)

3791 Photo-Neutron Production. E. der Mateosian and M. Goldhaber. AECU-757, Dec. 5, 1949. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Because of the incomplete state of our knowledge of gamma rays of sufficient energy to disintegrate Be or D, we have recently begun a systematic search for such gamma-ray emitters. The photoneutrons are slowed down in paraffin and detected by $B^{10}F_3$ counters. The sensitivity of the arrangement is such that 1 μc of Ra inside Be produces 35 cts/min above a background of 10 cts/min. With this sensitivity the difficulty lies not in the detection of weak gamma-ray branches (of the order of 10^{-6} or less), but rather in the exclusion of photoneutron producing impurities. Two new cases were established: Ag^{110} (225 days) and Bi^{206} (6.4 days) which produce photoneutrons in Be, but not in D_2O. For approximately equal γ intensities measured by an air ion chamber shielded with ¼-in. lead, the neutron counting rate was

$\frac{1}{2,000}$ for Ag^{110}, and $\frac{1}{3}$ for Bi^{206} in comparison with Ra-γ-Be. The energy of the gamma rays responsible is not yet known for Ag^{110}, but from Bi^{206}, a 1.72 gamma ray has been observed in a lens spectrometer to which the photoneutrons can be ascribed (see AECU-756). (auth)

3792 Scattering of 4.5 and 5.5 Mev Neutrons by Deuterons. E. Wantuch. AECU-772, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Atmospheric pressure deuterium gas was bombarded with neutrons from the D (d, n) He^3 reaction. Incident deuterons were accelerated in the Van de Graaff generator at the Department of Terrestrial Magnetism. Recoil deuterons (but not disintegration protons) were measured with thin-window twofold coincidence proportional counters of 1 μsec resolving time.

The following table shows preliminary results. Background was at most one-third of total counts. The counting errors are ± 10%, due mostly to uncertainties in monitoring.

Scattering Angles in Lab. System	0 deg	10 deg	20 deg	30 deg
Neutron energy, Mev	Net Number of Coincidences			
5.5 ± 0.1	2300	2400	1200	400
4.5 ± 0.2	2300	2000	1200	

Using the yield curves of Hunter and Richards (Phys. Rev. 76, 1445(1949)) the differential scattering cross section at 0^0 (in the laboratory system) was determined to be 0.25 ± 0.10 barns per steradian.

The results are compared with the theory of Buckingham and Massey (Proc. Roy. Soc. A179, 123(1941)). (auth)

3793 Neutron Detection by Means of Film Blackening and Related Shielding Phenomenons. T. E. Shea, Jr. ORNL-639, Mar. 31, 1950. 22p.

As a result of the findings by Ben Kalmon (ORNL-394), an investigation into the usefulness of commercial films (not special particle emulsion formulas) for fast-neutron monitoring was carried out. The substitution of darkening rather than the counting of "proton recoil tracks" was investigated as a method of detection. Lead shields as an intensifying screen in fast-neutron flux was studied. This intensification is believed to be due to the γ rays emitted by the inelastic scattering of neutrons in Pb. Five commercial-type films were exposed to Po-Be fast-neutron flux representing 2.5×10^7 to 1×10^9 N_f/cm^2. The density of the open-window portion of the film was in all cases less than the blackening behind the lead shield. All the films were sensitive to radiation from 5×10^7 N_f/cm^2 or greater. One type of film (Ansco Process) showed straight-line response when increasing flux was plotted against density. 14 references.

3794 Activities Produced by Thermal Neutrons. F. E. Senftle and W. Z. Leavitt. Nucleonics 6, No. 5, 54-63(1950) May.

The authors have compiled a "Table of Nuclides Produced by Thermal Neutrons" by means of which the expected activity after a given irradiation time at a known flux can be estimated for various materials. Since the relative abundance of the parent isotope has been considered in each case and since the table is based on 1 g of element in a flux of 10^9 neutrons/cm^2/sec, the "specific saturation activity" A_s could be tabulated. After an irradiation of t sec, the activity A_t in disintegrations per second, of a particular radionuclide of half-life T at θ sec after removal, is given by:

$$A_t = A_s \left[1 - e^{-0.693t/T}\right] \left[e^{-0.693\theta/T}\right].$$

The two expressions in brackets are evaluated by means of an accompanying curve, and the determination is thus reduced to a simple slide-rule operation.

3795 Random Sampling (Monte Carlo) Techniques in Neutron Attenuation Problems. I. Herman Kahn. Nucleonics 6, No. 5, 27-33, 37(1950) May. (See also NSA 3-990.)

In this first half of the article, the stochastic method is discussed as a simplified method of making complex calculations without advanced calculating machines. Random sampling is illustrated as a technique for estimating such multiple dimensional integrals as are met with in neutron attenuation problems.

3796 The Effect of Electronic Paramagnetism on Nuclear Magnetic Resonance Frequencies in Metals. C. H. Townes, Conyers Herring, and W. D. Knight. AECU-785, nd. 7p.

The difference in the nuclear paramagnetic resonance frequency between an atom in the metallic state and in a nonmetallic state is thought to be due to the interaction of conduction electrons, which have a high probability density near the nucleus, and the nucleus. The fractional shift in nuclear resonance frequency between metal and nonmetal is the fractional amount by which the presence of the conduction electrons increases the mean magnetic field strength at the nucleus. It is these fractional magnetic field shifts, $\Delta H/H$, which the authors calculate for Li, Na, Cu, Be, Pb, Al, and Ga and compare with measured values for hyperfine structure splitting for an s electron in certain isotopes of these elements.

3797 Velocity Dependent Nuclear Interactions. C. H. Blanchard, R. Avery, and R. G. Sachs. AECU-810, nd. 4p.

Recent consideration of the relationship between nuclear shell structure and a jj coupling scheme (Mayer, Phys. Rev. 75, 1969(1949); Haxel et al, Phys. Rev. 75, 1766(1949)) suggests the investigation of nucleon-nucleon interactions which give spin-orbit coupling directly. Invariance requirements, in nonrelative theory, limit the possible interactions linear in nucleon momenta. This paper reports the results of a brief preliminary investigation of the effects of these forces in the nuclei H^2, H^3, and He^3.

3798 β Decay and the Nuclear Shell Model. L. W. Nordheim. Phys. Rev. 78, 294(1950) May (Letter to the editor).

The nuclear shell model is applied to the spin-orbit coupling, and a list of rules is formulated which apply to the various transitions.

PHSYICS

3799 Excited States of Be^7. J. C. Grosskreutz and K. B. Mather. Phys. Rev. 77, 580-4(1950) Mar. 1.

Evidence for the existence of excited states of Be^7 below 1 Mev has been found from a study of the neutrons produced in the reaction $Li^7(p,n)Be^7$. Using a homogeneous beam of protons of 5 Mev energy from the Washington University cyclotron, the authors detected neutrons by a standard photographic-plate method. In addition to the ground-state group of neutrons, three additional lower energy groups were observed, indicating an excited level structure for Be^7. Three separate runs on three separate targets of varying thickness gave the same results. Observations were made at 20 and 90 deg to the proton beam for each target. In every case the shift in energy of the peaks as one goes from 90 to 20 deg is consistent with the assignment of definite levels to Be^7. Values obtained for the level excitation energies are 0.205 ± 0.070 Mev, 0.470 ± 0.070 Mev, and 0.745 ± 0.070 Mev above the ground state. The level at 470 kev is presumably analogous to the well-known level at 478 kev in the mirror nucleus Li^7. Levels in Li^7 corresponding to the other two levels found in Be^7 have as yet not been observed, and may, of course, not exist. The Q for the ground-state reaction was found to be -1.65 ± 0.04 Mev, in good agreement with previously obtained values. (auth)

3800 On the Structure of γ Lines of RaC. A. A. Bashilov, N. M. Anton'eva, and A. V. Zolotavin. Doklady Akad. Nauk S. S. S. R. 70, 793-6(1950)(in Russian).

Latyshev et al. (Izvestiya Akad. Nauk S. S. S. R., Ser. Fiz. 12, 732(1948); 13, 340, 443(1949)) have found that the internal-conversion lines of the β spectrum of RaC were broad and presented numerous regularly spaced indentations, a shape that has been interpreted by those investigators as revealing a fine structure of the corresponding γ lines. The present authors repeated the measurements, using a β spectrometer of a higher resolving power ($\Delta H\rho/H\rho = 0.5$ to 0.2%) and employing as a source an active deposit produced by Rn upon a 5 μ-thick Al foil, whereby the distorting influence of the ampoule glass was excluded. They established that, contrary to the findings of Latyshev and collaborators, the lines 606, 1120, 1414, and 1760 Mev have a very narrow profile and present none of the indentations described by the last-named writers.

3801 Scarcity of States of Li^7, from Magnetic Observation of $Be^9(d,\alpha)Li^7$. D. R. Inglis. Phys. Rev. 78, 104-9 (1950) Apr. 15.

The α spectrum of the reaction $Be^9(d,\alpha)Li^7$ was observed at a bombarding energy of 600 kev. Above the well-known 480-kev excited state of Li^7 there is no further excited state having a transition as much as 5% as intense as the ground-state transition in the range of excitation energies up to 2.5 Mev; and from there, where the $(d,2\alpha)$ reaction begins to obscure the observations, up to 3.6 Mev, there is no sharp line more than 10% as intense as the ground-state line. The observations were made with a magnetic heavy-particle spectrograph giving an extended spectrum with a second-order focus on a photographic plate. (auth)

3802 Pile Neutron Research Techniques. II. D. J. Hughes. Nucleonics 6, No. 5, 38-53(1950) May. (See also NSA 4-3192.)

PHYSICS

In this second part of his article the author describes the instrumentation and techniques for thermal neutron studies, both inside and outside a pile. Among the subjects included are the determinations of short half-lives by use of high-speed "rabbits" and other devices, cross-sectional measurements, crystal diffraction, neutron mirrors, diffusion measurements, and mechanical velocity selectors and "choppers." The extensive bibliography is continued from Part I.

3803 Uranium 235 and Plutonium 239. F. Comparay, et al, Paris, Hauthier-Villars, 1948. 109p. (in French).

This book discusses our modern knowledge of the constitution of matter, the transformation of matter into energy, the method followed by the United States in the production of atomic bombs, and the methods by which useful power could be obtained from the sources of nuclear energy.

3804 The Cross Section of (n, 2n) Reactions Near the Threshold. George Snow. AECU-755, Dec. 5, 1949. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The energy dependence of the cross section of (n, 2n) reactions near the threshold is derived using the nuclear dispersion theory formalism (Wigner and Eisenbud, Phys. Rev. 72, 29(1947)). Configuration space is divided into three regions: an internal region, corresponding to the compound nucleus; an intermediate region, in which one neutron and the remaining nucleus are sufficiently far apart so that their nuclear interaction vanishes; and an external region, in which two neutrons do not interact with the residual nucleus. Boundary conditions are derived for the stationary wave function in the external region. An approximation to these boundary conditions allows the determination of the external-region wave function, whose asymptotic form yields the result $\sigma(n,2n) \cong (E - E_t)^2$, where E is the incident neutron energy in the center of the mass system, and E_t is the (n, 2n) threshold energy. The neutron-neutron interaction in the external region does not alter the energy dependence of $\sigma(n,2n)$ near the threshold. This derivation is valid for an energy range too small to allow comparison between theory and experiment. A crude perturbation theory argument yields the same result for $\sigma(n,2n)$.

3805 A Correction to be Applied to the Activity of Neutron Activated Cadmium Covered Indium Foils. John W. Kunstadter. AECU-819, Mar. 16, 1950. 5p.

One common method of measuring a slow neutron flux involves the use of foils of some material having a high neutron activation cross section in the resonance region. A necessary part of the technique is the activation by neutrons of one known energy. This is most easily done by the use of cadmium covers on the foils, since cadmium is transparent to neutrons in the resonance region above the 1 ev, and is effectively black in the 1/v region below about 0.4 ev. The low-energy end of the resonances of some elements, notably indium, extends below the cadmium cutoff (Goldsmith, et al, Revs. Modern Phys., 19, 259-97(1947)), and a correction depending on the cadmium thickness used must be applied to the calculated activity to account for those neutrons normally captured by the resonance, but which are absorbed by the

PHYSICS

cadmium. An investigation of this correction as applied to indium was made in a constant and well-known flux of graphite-moderated neutrons from a 1-g Ra-Be source. A tabulation of correction factors for various thicknesses and of other data is given.

3806 The (e,n) Process on the Deuteron. Friedrich Schlögl. Z. Naturforsch. 4a, 664-71(1949) Dec. (in German).

The author considers the reaction $H^2 + e - H^1 + n + e$. The reaction cross section and the energy spectrum of the resultant neutrons are calculated for electron energies of a few Mev. In the calculation the interaction between the electron and proton is treated as a perturbation, but the influence of the radiation field which would lead to higher order processes is not considered.

3807 Fission and Nuclear Shell Model. Lise Meitner. Nature 165, 561(1950) Apr. 8 (Letter to the editor).

It seems likely that closed shells consisting of 50 or 82 neutrons may persist as a definite structure in nuclei even when the nuclei are moderately excited. If this is true, it is to be expected that the uranium fission fragments should contain closed shells of 50 and 82 neutrons, with the extra neutrons being equally distributed between the two fragments. Since the closed shell of 50 neutrons is connected with $Z \geq 36$, and 82 neutrons with $Z \geq 54$, it follows that, for the lighter fragment the charge must lie between 36 and 38, while for the heavier fragment the charge must be between 56 and 54. These conclusions agree very well with the experimental results. Because of the evaporation of neutrons which precedes fission in bismuth, there are not enough neutrons present after fission to form shells of 50 and 82 neutrons, so both fragments contain shells of 50 neutrons. It is pointed out that the shell structure cannot persist in highly excited nuclei, and the fission induced by fast neutrons in uranium usually results in more nearly equal fission fragments for this reason.

3808 Neutron Groups from the Reaction $Li^7(p,n)Be^7$. Bernard Hamermesh and Virginia Hummel. Phys. Rev. 78, 73-4(1950) Apr. 1 (Letter to the editor).

Recent reports (Grosskreutz et al, Phys. Rev. 77, 580 (1950); Brown et al, 78, 88(1950)) indicate the existence of at least one excited state in Be^7 within 1 Mev of the ground state. Therefore the reaction $Li^7(p,n)Be^7$ should give rise to at least two groups of neutrons of different energies, depending upon whether the reaction leads to Be^7 in the ground state or in an excited state. Photographic plates (Ilford C2 emulsions 50 μ thick) have been exposed to neutrons produced in this reaction by protons with energies of 2.705 and 3.120 Mev from the Argonne electrostatic accelerator. By studying the recoil protons in the emulsions, the energies of the neutrons can be found. Four neutron groups appear in the spectrum, and their energies are tabulated. Two of the groups had very low intensity, and their interpretation is questionable, but one group, at 428 kev, with an intensity of about 8% of the intensity of the main group, seems to correspond to an excited state in Be^7.

3809 Nuclear Transmutations of Carbon-13. C. D. Curling and J. O. Newton. Nature 165, 609-10(1950) Apr. 15 (Letter to the editor).

PHYSICS

Thin deposits of C^{13} were bombarded with protons and and deuterons with energies up to 1 Mev. The results of observations are given here which were made on the resultant reactions $C^{13}(p,\gamma)N^{14}$, $C^{13}(d,p)C^{14}$, and $C^{13}(d,\alpha)B^{11}$.

3810 On the Phenomenon of Anomalous Activities Induced by Deuterons in a Mass of Silver. C. Chamié. J. phys. radium 11, 77-9(1950) Feb. (in French).

In bombarding the surface of silver (and gold) with deuterons (6.5 Mev), two distinct phenomena are observed in the metal mass: the first type of phenomenon is the reaction leading to the formation of cadmium, a reaction which drops off in intensity with increasing depth; the second is a different reaction which gives rise to an anomalous activity, an activity which reaches a maximum near the end of the deuteron range. An experimental procedure is proposed for determining the range of the deuterons. Beyond the deuteron range, in a region extending from the deuteron range up to four times the deuteron range, a similar type of anomalous activity has been observed. This activity is attributed to a reaction similar to the reaction responsible for the anomalous activity near the end of the deuteron range, but induced by protons instead of deuterons. A working hypothesis is given for the interpretation of these phenomena.

3811 On the Energy Loss by Fission Fragments along Their Range. N. O. Lassen. Kgl. Danske Videnskab. Selskab Mat.-Fys. Medd. 25, No. 11(1949). 43p.

Measurements of specific ionization vs. traversed distance, for the case of uranium fission fragments in argon, were previously reported (Lassen, Phys. Rev. 70, 577(1946)). Chapter 1 of the present paper gives a more detailed account of these experiments. Chapter 2 deals with corresponding investigations with other gases. In Chapter 3 an attempt is made to combine such ionization results for the first portion of the range with cloud-chamber and theoretical results on nuclear collisions for the terminal portion. The velocity versus distance and effective charge versus distance are also treated.

3812 Photo-Alpha-Reactions in Oxygen and Nitrogen. C. H. Millar and A. G. W. Cameron. Phys. Rev. 78, 78-9(1950) Apr. 1 (Letter to the editor).

An Ilford E1 emulsion, 100 μ thick, was exposed to 200 r of γ radiation from the 24-Mev betatron at the University of Saskatchewan. The plate was enclosed in cadmium at the middle of 1 ft^3 of paraffin to eliminate reactions caused by photoneutrons. A modified Van der Grinten "grain-gradation" development (Yagoda, Radioactive Measurements with Nuclear Emulsions. New York, John Wiley, 1949, p. 62.) of the plate minimized γ-ray fogging, suppressed proton tracks, and made α-particle tracks distinguishable from those of heavier particles. A few α-particle tracks having a short, heavy stub at the origin were attributed to photo-α-reactions in light nuclei. The energy of each recoil fragment was calculated from the energy and momenta of the associated γ and α and from the general form of the range-energy relation. Both methods agreed fairly well, and it was possible in this way to identify the fragments as B^{10} and C^{12} resulting from the photodisintegration of N^{14} and O^{16}. A range-energy curve for C^{12} ions, obtained from this data, is given. The theoretical range-energy relation gives a good fit if an effective

charge of 3.62 electronic units is assumed. For the B^{10} range energy curve, an effective charge of 2.94 gives the best fit.

3813 Radio Frequency Problems Associated with Particle Accelerators. J. P. Blewett. AECU-752, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The machines which provide the nuclear physicist with high-energy electrons, protons, or other nuclear particles depend, for the most part, on acceleration in radio-frequency electric fields. The radio-frequency is synchronized with the particle motion in such a way that the particle experiences a multiplicity of small accelerations and finally emerges at high energy. The cyclotron, the linear accelerator, and the synchrotron all belong to this class. In the ordinary cyclotron, the linear accelerator, and the electron synchrotron the frequency is held constant, but in the frequency-modulated cyclotron and the proton synchrotorn the frequency must change during the accelerating cycle, sometimes by factors of 10 to 1 or more. The generation and frequency control of the r-f signal and its application to the particles under acceleration all present novel problems of considerable difficulty. This paper will be concerned with the new techniques which have been developed in the solution of these problems. (auth)

3814 A 300 to 4000-Kc Electrically Tuned Oscillator. A. I. Pressman and J. P. Blewett. AECU-784, nd. 19p.

An oscillator for use with a proton-synchrotron is described whose frequency is electrically controllable over a 12 to 1 frequency range. Tuning is accomplished by saturation of a ferromagnetic core in the inductance of the tank circuit. The output is constant in amplitude to within 5% and is reproducible in frequency to better than 0.1%. Several saturable inductance designs are described. (auth)

3815 Integrator-Expander Circuits for the Control of the Maximum X-ray Energy from the Betatron. L. Katz, A. G. McNamara, P. A. Forsyth, R. N. H. Haslam, and H. E. Johns. Can. J. Research 28A, 113-19(1950) Mar.

The electronic circuits known as an "integrator-expander" were constructed for the accurate control of the x-ray energy of the University of Saskatchewan betatron. The over-all design and operation of the circuits are discussed. The design of the energy bias control, amplifier, and trigger portions of the circuit is original, and these are described in some detail. (auth)

3816 Pulser and Water Load for High Power Magnetrons. S. Ingvar Svensson. Chalmers Tek. Högskol. Handl. 1948, No. 68. 28p.

An experimental pulser of the line modulator type has been developed to pulse the 1-mw, 10-cm magnetron HK7T, and a calorimeter wattmeter, or water load, of the coaxial type has been built to measure the pulsed high power output. Details of construction and performance are given for each. The magnetrons will be used as microwave power generators in a linear electron accelerator.

3817 On Scattering Induced Curvature for Fast Charged Particles. William T. Scott and H. S. Snyder. AECU-793, Dec. 29, 1949. 24p.

The exact solution recently obtained (Snyder and Scott, Phys. Rev. 76, 220(1940)) for the small-angle plural and multiple scattering of fast charged particles is used to derive several theorems of interest concerning scattering-produced curvatures, and calculations are reported of the probability distribution of such curvatures. Formulas are provided for obtaining the probability of occurrence of curvatures greater than any given amount for any scattering material and energy, as long as the scattering is not too large. The types of curvature measurement dealt with are: (a) three-point observation; (b) mean curvature using the tangents to the track at each end; (c) difference between the two curvatures obtained in (b). Asymptotic formulas allow the calculations to be extended for unusually rare events. It is shown, first, that knowledge of the probability of a lateral displacement x after a track length z is sufficient to find the distribution of scattering-produced curvatures c obtained by observing the ends of the track and any one interior point. The appropriate relationship is $x = z^2c/2$. It is further shown that by introducing a lateral displacement angle $\phi = x/z$, the probability of observing ϕ in length z may be obtained by a "duplication formula" from the distribution in ϕ_1 at any $z_1 < z$ and the distribution in $\phi - \phi_1$ in a track of length $z - z_1$. From the basic correlated distribution formula, distributions have been obtained for the curvatures of the two circles tangent to either end of the track and passing through the other end. The mean $\bar{c}$ of these two curvatures (a special "four-point" curvature) follows the same distribution law as the directional distribution of the previous paper, (ibid.) with $\eta = z\bar{c}$. The difference of these curvatures, D, follows the same law as the three-point curvature c, above. Finally it is shown that the distribution in x and η, or in c and $\bar{c}$, are nearly the same if the expressions $\eta = \sqrt{3}(x/z)$ or $\bar{c}$ $(\frac{1}{2})\sqrt{3}c$, are written although the exact solution yields different expressions for the appropriate Fourier transforms. Calculations are reported and summarized in graphs of the differential and integral distributions in $\phi = x/z$, in terms of dimensionless units z/λ and ϕ/η_0 as in the previous work (ibid.). Integral distributions in angular displacement η, derived from the previous calculations, are included for completeness. (auth)

3818 Scattering and Capture of Protons by Aluminum. F. C. Shoemaker, J. E. Faulkner, S. G. Kaufmann, and G. M. B. Bouricus. AECU-816, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Thin films of aluminum were bombarded with protons from the Wisconsin pressure generator. By use of the techniques developed in preliminary work (Bender, et al, Phys. Rev. 76, 273(1949)), yield curves covering the region from 1.4 to 4.1 Mev were obtained for elastically scattered protons (resolution ~ 2 kev), alpha particles (resolution ~ 6 kev), and gamma radiation. These curves show a large number of resonance levels with widths ranging from ~ 30 to ~ 1.5 kev. The general level of the elastic scattering decreases from 1.4 to 2.0 Mev and then remains substantially constant. The alpha yield, essentially zero between resonances, shows a general increase at resonance with increasing proton energy. The intensity of hard gamma radiation at resonance apparently does not increase appreciably with increasing proton energy, but an intense, very soft (~ 1 Mev) component is found at high proton energies. Inelastically scattered protons and

PHYSICS

low-energy alphas were found which, it is believed, account for this. All charged particle yields were observed at 165 deg in the laboratory system. (auth)

3819 Deuteron-Proton Scattering at 10 Mev. K. B. Mather, H. J. Karr, and R. O. Bondelid. Phys. Rev. 78, 292-3(1950) May (Letter to the editor).

The coincidence scattering chamber referred to in an earlier communication has been applied to the determination of absolute differential cross sections for the elastic scattering of deuterons by protons. Deuterons were accelerated to 10.0 ± 0.2 Mev and scattered in nylon and polyethylene-terephthalate foils. A table is given showing absolute cross section as a function of angle of scattering.

3820 The Inelastic Scattering of Protons by Magnesium, Aluminum, and Other Light Elements. E. H. Rhoderick. Proc. Roy. Soc. (London) 201A, 348-65(1950) Apr. 26.

This is an extended version of an article which appeared in Nature 163, 848(1949) and which was listed in Nuclear Science Abstracts as Abstract 3-714.

3821 The Interpretation of Low Energy Proton-Proton Scattering. J. David Jackson and John M. Blatt. Revs. Modern Phys. 22, 77-118(1950) Jan.

For P-P scattering at low energy (< 4 Mev), the wavelength is large compared to the range of nuclear forces. Hence the interaction is effective only in the S-states of the system and involves only one nuclear phase shift, the one for the ^{1}S-state. Landau and Smorodinsky (J. Phys. U.S.S.R. 8, 154(1944)) have pointed out that, assuming a zero range interaction, a certain function of the nuclear phase shift and of the velocity of the protons should be independent of energy. This paper analyzes the experimental P-P scattering data on the basis of this function. The relationship between P-P and N-P scattering is discussed.

3822 On the Magnetic Scattering of Fast Electrons in a Ferromagnetic Crystal. Toshinosuke Muto, Kenzo Inoue, and Ichie Watanabe. J. Phys. Soc. Japan 4, 251-7(1949) Dec.

Since attempts at observing polarization of electron waves have been unsuccessful or indecisive when involving the elastic scattering by electrostatic fields within a crystal, it is thought that use may be made of the magnetic scattering in the Weiss molecular field within ferromagnetic materials. To determine the possible magnitude of this effect and the likelihood of its being masked by other factors, the authors have calculated the magnetic scattering of a Dirac electron in Fe, both with and without spin change. Results are inconclusive.

3823 On Strongly Absorbing Materials for Radiation Protection. K. G. Zimmer. Fortschr. Gebiete Röntgenstrahlen vereinigt mit Röntgenpraxis 71, 143-4 (1949)(in German).

The possibilities of using sintered thorium oxide, thorium, or uranium as protective materials are stressed, and their absorption relative to that of lead is given for different radiation qualities from 60-kv x-rays to radium γ rays.

PHYSICS

3824 Isomerism in Pb^{204} and Radiations of Bi^{204} and Bi^{206}. A. W. Sunyar, D. E. Alburger, G. Friedlander, M. Goldhaber, and G. Scharff-Goldhaber. AECU-756, Dec. 1949. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The even-even isomer Pb^{204} (68 min) is found to decay in two steps. A 905-kev γ ray (~10% internally converted, K/L ratio ~1) is followed by a 374-kev γ ray (~5% internally converted, K/L ratio ~3) with a half-life of 3×10^{-7} sec. The results can be interpreted by assuming that a transition of multipole order 6 is followed by one of multipole order 3. This requires a spin between 7 and 9 units for the upper metastable state of remarkably high excitation energy (1,279 kev). The Pb^{204} was separated from its parent, Bi^{204} (12 hr), which was produced by deuteron bombardment of lead in the MIT cyclotron. The internal conversion electrons were studied in a lens spectrograph. Bi^{204} studied in equilibrium with its daughter showed additional lines corresponding to a 217-kev transition. Weaker lines might have been masked because of the presence of Bi^{206} (6.4 days) which shows an extraordinary number of lines corresponding to the following γ-ray energies: 182, 234, 260, 341, 396, 470, 505, 536, 590, 803, 880, 889, 1,020, 1,097, 1,720 kev. (auth)

3825 The β Spectrum of Be^{10}. D. E. Alburger, D. J. Hughes, and C. Eggler. AECU-759, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The beta-ray spectrum of Be^{10} has been measured, using a lens spectrometer. The source was formed by neutron irradiation of Be in the Hanford pile, followed by careful chemical purification. A 1200-fold electromagnetic enrichment to 0.3% Be^{10} was then performed at Oak Ridge under the direction of C. P. Keim. Enriched BeO was finally deposited in suspension over an area 1.5 cm in diameter on a 0.08 mg/cm^2 nylon backing. Effects of the 0.4 mg/cm^2 source thickness and 17% resolution used because of the low Be^{10} activity were investigated by separate experiments on the Na^{22} positron spectrum which has about the same end point. Thin sources of Na^{22} run under the same conditions and corrected for resolution and 0.5 g/cm^2 counter window thickness showed accurate linearity of the Kurie plot down to 100 kev. Sources ~ 0.4 mg/cm^2 of Na^{22} mixed in inert BeO gave linear Kurie plots down to 170 kev. The Kurie plot of Be^{10} with additional correction by Marshak's D_2 factor is linear from the 560 ± 5 kev end point down to about 180 kev and has deviations below that point similar to the thick Na^{22} source results. This indicates that the Be^{10} beta-ray distribution follows the theoretical D_2 shape at least down to 100 kev. (auth)

3826 Low Energy Photons from Radioactive Nuclei. Gertrude Scharff-Goldhaber, E. der Mateosian, M. McKeown, and A. W. Sunyar. AECU-767, Dec. 5, 1949. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Low-energy photons have been observed for a number of radioactive nuclei with the help of an argon-filled proportional counter. The following results have been obtained:

PHYSICS

	Sm^{151}	$Gd^{(153)}$	Pa^{231}	U^{234}
Energy of γ rays in kev	21	26	27	
x-rays observed	L	K, L	$L_I L_{II} L_{III}$	$L_I L_{II} L_{III}$

The 24-kev electrons reported by Teillac for Pa^{231} and interpreted as L electrons of a 44-kev transition are reinterpreted as M electrons of the 27-kev transition. Although no unconverted γ rays could be detected from U^{234}, it is shown that it is more plausible to ascribe the L radiation to a highly converted nuclear transition following at least one-quarter of the α transitions rather than to excitation of the electronic shell by the α rays as suggested by Macklin and Knight. (auth)

3827 The Half-Life of Carbon 14 and a Comparison of Gas Phase Counter Methods. Warren W. Miller, Robert Ballentine, William Bernstein, Lewis Friedman, A. O. Nier, and R. D. Evans. AECU-780, nd. 5p.

Of three published determinations of the half-life of C^{14} by methods allowing 5% accuracy or better, only two are in fairly close agreement. Both of the latter procedures involved expansion and dilution of active CO_2 gas to obtain samples which were counted as small partial pressures of CO_2 in argon-alcohol G-M counters. The first determination was obtained by diluting as carbonate ion in solution and counting in a differential CO_2-CS_2 G-M counter which eliminates end effects. Experiments are reported in which two separate, complete determinations have been made. One was made, using a CO_2-CS_2 G-M counter system with results as before. The second determination was made by a proportional-counter method and agreed closely with the two values by the argon-alcohol G-M counters. The five determinations fall into 2 groups, one with two values at 6,400 years and the other with three values at 5,600 years. It is concluded that the latter value is probably more correct, and the CO_2-CS_2 G-M counters may have an efficiency of only about 85%.

3828 Interaction of β Rays from RaE with Matter. Shoji Kojima and Shizuko Hashimoto. J. Phys. Soc. Japan 5, 20-2(1950) Feb.

The possible creation of pair quanta from the kinetic energy of fast electrons was investigated, using the coincidence method of Feather and Dunworth (Proc. Cambridge Phil. Soc. 43, 435(1938)). The β rays from RaE (Bi^{210}) were stopped in various absorbers, and the cross sections for quanta pair production were calculated, from the number of otherwise unexplained coincidences, as 1.3 ± 0.6 barns for Pb and 4.2 ± 2.1 for Sn. These are much higher than theory predicts, and the coincidences might be better explained as due to double Bremsstrahlung.

3829 Internal Conversion Coefficients for Co^{60}. M. A. Waggoner, M. L. Moon, and A. Roberts. Phys. Rev. 78, 295(1950) May (Letter to the editor).

The conversion coefficients of the two γ rays from Co^{60} were obtained by means of the β spectrum in a double-coil thin-lens spectrometer. The coefficients, for unresolved K, L, and M shells, were found as $1.733 \pm 0.061 \times 10^{-4}$ and $1.286 \pm 0.035 \times 10^{-4}$ for the 1.1715- and 1.3316-Mev rays, respectively.

3830 An Investigation of the Alpha-Ray Spectrum of Polonium. John J. Wagner. P. 122-123 in: Microfilm Abstracts, Vol. X, No. 1. Ann Arbor, University Microfilms, 1950.

A 180-deg magnetic spectrograph was employed to study the α particles emitted by polonium. A source with silver backing was studied extensively, and more than 30 groups of α particles with various energies were found between 3.85 Mev and the main line at 5.3 Mev. The author concludes that this group structure of the α spectrum from polonium is not an occasional occurrence, that the groups observed by him are not directly nuclear in origin, and that no satisfactory explanation of them is apparent.

3831 The Radioactivity of Manganese, Mn^{54}, Disintegration by Consecutive Orbital Electron Captures of Barium, Ba^{131}, to Xenon, Xe^{131}. Donald Nason Gideon. pp. 257-262. In Abstracts of Dissertations Presented by Candidates for the Degree of Doctor of Philosophy, 1947-1948. Columbus, Ohio State University, 1949.

The radioactivity of Mn^{54} was observed in a cloud chamber, with the following results. No positron tracks were observed on 2,000 photographs, but 1,800 negative tracks were found with a maximum energy near 1 Mev. The transition involved is probably forbidden, but the evidence is not conclusive. The β decay is followed by the emission of a 0.835-Mev γ ray. Measurements of the activity of Ba^{131} were obtained by absorption and with the cloud chamber. This isotope was found to decay by K capture. No positrons were found on 300 cloud-chamber photographs. However, three γ rays were detected, and their energies were measured. The results of this investigation also indicated that Cs^{131} decays to stable xenon by k capture. Again, no positrons seem to be produced in this process, but a partially converted 140-kev γ ray was observed. The half-life of the Ba^{131} activity was found to be 11.9 days; of Cs^{131}, 10.0 days.

3832 The Self Energies of Electrons and Photons. Hartland S. Snyder. AECU-764, Nov. 23, 1949. 1p.

The document is in abstract form; it is reproduced below in its entirety.

It has generally been supposed that the self-energy of an electron as determined by the application of perturbation theory to the interaction of the electron-positron field with the electromagnetic field is necessarily infinite. However, by the use of appropriate limiting procedures one can make both the electron and photon self-energies vanish to order α. The procedure used is relativistically invariant. A paper concerning these matters is being prepared for publication. (auth)

3833 Quantum Field Theory. Hartland S. Snyder. AECU-789, Jan. 26, 1950. 18p.

It is usually contended that the Quantum Theory of Fields is intrinsically divergent. The present paper attempts to show that this divergence is due to the perturbation theory generally employed and not to the Field Theory itself. By means of a minor modification in the perturbation calculations, the divergent integrals may be given appropriate finite values. Although there are many apparent ambiguities in Field Theory, these are ambiguities of representation and not ambiguities in physical content. The self-energy and stress of particles are zero. The expectation value of the energy momentum tensor for the true vacuum state is zero. From this point of view the polarization of the vacuum and charge renormalization seem to be factitious. (auth)

PHYSICS

3834 Quantum Electrodynamics; The Self Energy Problem. Hartland S. Snyder. AECU-794, Nov. 29, 1949. 14p.

In this paper it is shown that the limiting processes, by means of which the integrals of the Hamiltonian of the interacting electron-positron field with the electromagnetic field are defined, may be carried out so that the self-energies of the electrons and photons are zero. A momentum space representation is used. (auth)

3835 A Classical Picture of Materialization and Dematerialization. Felix Joachin Wisniewski. Compt. rend. 230, 372-3(1950) Jan. 23 (in French).

In 1911 Silberstein considered the possibility of the existence of a particle consisting of a positive and negative electron. The mass of such a particle was calculated, considering only the electric field of each particle. This calculation has been extended to include also the magnetic field due to the magnetic moment of the electron. It turns out that, for $l = 0$, the mass and magnetic moment of this particle would be zero. It is proposed that the annihilation and creation of pairs is connected with the formation and decay of such a composite particle.

3836 An Identity in Quantum Electrodynamics. J. C. Ward. Phys. Rev. 78, 182(1950) Apr. 15 (Letter to the editor).

It has been recently proved by Dyson (Phys. Rev. 75, 1736 (1949)) that all divergencies in the S matrix of electrodynamics may be removed by a renormalization of mass and charge. Dyson defines certain fundamental divergent operators Γ_μ, S'_F, D'_F and gives a procedure for the calculation of their finite parts $\Gamma_{\mu 1}$, S'_{F1}, D'_{F1} by a process of successive approximation. It is then shown that

$$\Gamma_\mu = Z_1^{-1}\Gamma_{\mu 1}(e_1),\ S'_F = Z_2 S_{F1}(e_1),\ D'_F = Z_3 D_{F1}(e_1),$$

$$e_1 = Z_1^{-1} Z_2 Z_3^{1/2}\, e,$$

where Z_1, Z_2, and Z_3 are certain infinite constants, and e_1 is the renormalized electronic charge. Dyson conjectured that $Z_1 = Z_2$; the author gives a formal proof of this relation.

3837 The Influence of the Nuclear Field on the Movement of Electrons. D. Ivanenko and V. Rodichev. Doklady Akad. Nauk S. S. S. R. 70, 801-4(1950)(in Russian).

The behavior of atomic electrons at close distances from the nucleus reveals the existence of interactions other than the electromagnetic and the electrostatic. In previous works the authors have predicted the existence of an attraction between the electron and the neutron (Zhur. Eksptl. i Teoret Fiz. 11, 198(1941)) and, by taking into consideration the size of the nucleus, have introduced certain corrections into the expressions for the electron wave functions (ibid. 18, 434 (1948)). In the present paper a further theoretical investigation is made of these "proximo-nuclear" effects, comprising both (1) the known phenomena of hyperfine structure due to the nuclear magnetic moment and to isotopic displacement due to the motion of the nucleus, and (2) the more recently studied, mainly hypothetical, effects that must be attributed to the "smearing-out" of the nucleon's electric charge, to the size of the nucleus, or to the specific nuclear interaction between nucleons and electrons.

3838 On Relativistic Quantum Mechanics. Walter Wessel. Z. Naturforsch. 4a, 645-53(1949) Dec. (in German).

New derivations are given of previously presented representation theory of a generalized Dirac equation (Z. Naturforsch. 3a, 559(1948)). The features of this theory stressed here are the relation to the theory of Bopp (Z. Naturforsch. 3a, 564(1948)), the spin characterization of the representations employed, the reality conditions of the finite and infinite representations, and the solution of the wave equation for certain eigenvalue parameters. (auth)

3839 Propagation of Electromagnetic Waves through a Stratified Medium; Part I. General Analysis. Bernard Salzberg. Naval Research Laboratory Report No. NRL-3472, Aug. 3, 1949. 17p.

A general analysis of the propagation of electromagnetic waves through a stratified medium is developed from Maxwell's equations. The medium is assumed to be divided into m plane-parallel layers, the first and mth of which are semi-infinite. The electromagnetic properties of the m layers are arbitrary and dissimilar and, in general, the thicknesses of the $(m - 2)$ finite layers are also different. A steady-state monochromatic plane wave, generated in the mth layer and having either its electric or magnetic vector normal to the plane of incidence, is assumed to be incident at any angle upon the $(m - 1)$th layer. Formulas for the resulting reflection and transmission are derived. (auth)

AUTHOR INDEX

For each reference the digit preceding the dash is the volume number and digits after the dash are the abstract number.

ADAM K R
4-3631
ALBURGER D E
4-3624 4-3625
ALLEN J G
4-3576 4-3578
ANDERSON A B
4-3630
ANDERSON R C
4-3721
ANDREW K F
4-3739
ANFINSEN C B
4-3643
ANTONEVA N M
4-3800
ARKIN A M
4-3601
ARNSTEIN H R V
4-3656
ARONOFF S
4-3644 4-3645
ATTEWELL T H D
4-3771
AVERY R
4-3797

BADDILEY J
4-3648 4-3649
BALAKRISHNAN C
4-3778
BALE W F
4-3634 4-3635
BALLENTINE R
4-3627
BASHILOV A A
4-3800
BASSETT L G
4-3712
BASSI P
4-3769
BATCHELOR R
4-3772
BEAL J M
4-3602
BENJAMIN J A
4-3666
BENNETT F A
4-3642
BENTLEY R
4-3661 4-3696
BERNSTEIN W
4-3760 4-3763 4-3827
BIGELEISEN J
4-3695
BISHOP C J
4-3595
BLACKMORE L
4-3772
BLANCHARD C H
4-3797
BLATT J M
4-3621
BLEWETT J P
4-3613 4-3814
BLY C G
4-3634 4-3635
BONDELID R O
4-3619
BOTHNER-BY A A
4-3721
BOURICUS G M B
4-3618
BOWEN V T
4-3646 4-3560
BOWERS J Z
4-3621
BOYD G A
4-3568
BRENNAN J T
4-3592
BREWER D W
4-3623
BREWER H G JR
4-3760
BROTHERS G B
4-3632
BROWN K B
4-3741
BRUCE R A
4-3632

BRUES A M
4-3591
BUBECK M R
4-3642
BUCK F A M
4-3701
BURCH G E
4-3676 4-3684 4-3686
4-3687
BURSTALL F H
4-3685
BUTLER J N
4-3710
BUTLER N
4-3600

CAMERON A G W
4-3812
CARLSON B
4-3788
CARO D E
4-3754
CARTER R E
4-3592
CATHEY W J
4-3719
CATON W L
4-3664
CHAMIE C
4-3810
CHANDLER J P
4-3672
CHAPMAN E M
4-3622
CHASE R L
4-3755 4-3762
CLAASSEN H H
4-3780
CLARK H M
4-3712
CLAYCOMBE C K
4-3608 4-3703 4-3719
4-3720
COLEMAN C F
4-3740
COMPARAY F
4-3603
COOK G B
4-3681
COON J H
4-3745
COOPER P D
4-3668
COULTER M
4-3581
CRABTREE H G
4-3633
CRAGGS J D
4-3778
CREGO F T
4-3603
CRENSHAW J F
4-3600
CROSBIE J A
4-3576
CROSS H C
4-3738
CROSS N
4-3672
CROSS W G
4-3765
CROUSE D J
4-3741
CULBRETH G G
4-3637
CULLEN M L
4-3671
CURLING C D
4-3809

DAMAST B
4-3638
DAVIDSON W F
4-3784
DAVIES G R
4-3685
DAVIS W JR
4-3727
DEL BUONO G
4-3596

DER MATEOSIAN E
4-3625 4-3791
DION H G
4-3657
DIXON F J
4-3650
DODSON R W
4-3705 4-3708 4-3716
DOMINE-BERGES M
4-3725
DOWNS W L
4-3627
DUMROSE R
4-3642
DUNCAN J F
4-3683
DUNN T B
4-3598
DUPUIS T
4-3688 4-3689
DURNAL R G
4-3726
DUTLI J W
4-3729
DUVAL C
4-3688 4-3689
DU VIGNEAUD V
4-3672

EDELMANN A
4-3584
EGGLER C
4-3625
EGNER W
4-3576
EHRENSVARD G
4-3648 4-3649
EIMER L
4-3708
ELGHAMMER R M
4-3576 4-3578
ELLIOT D F
4-3659
ELLIOTT N
4-3692
ELY J O
4-3594
EMELEUS H J
4-3698
EVANS E I
4-3655
EVANS R D
4-3627

FARQUHARSON J
4-3702
FARRAR M N
4-3697
FAULKNER J E
4-3618
FEARNSIDE K
4-3730
FILOSOFO I
4-3769
FINKLER R S
4-3612
FLANAGAN E K
4-3670
FLEMING T C
4-3641
FORLAND T
4-3694
FORSYTH P A
4-3615
FOSTER E H
4-3763
FOX [illegible]
4-3790
FRANTZ J M
4-3670
FRANZINI T
4-3767
FREDRICK W G
4-3604
FREYBERGER W L
4-3742
FRIEDLANDER G
4-3624
FRIEDMAN L
4-3717 4-3927